angular projections, and some of the fractures of the internal table.

The other variety embraces all those cases of collapse, stertor, and insensibility, which mark the action as being at once persistent and complete.

If the whole be reduced to a tabular form, it may be displayed thus :—

Commotion.

1. Fatal, without lesion or reaction of any kind (rare.)
2. Simple, with a brief and healthy reaction (ordinary concussion.)
3. Obscure, with a slow reaction, and recovery more or less complete.
4. Lesion of the substance of the brain with or without fracture of the cranium, uniformly fatal in the latter, and ordinarily so in the former case.

Compression.

1. Directly fatal, whether from the nature or extent of the mischief.
2. Not directly fatal but remediable by art, and occurring in one of two forms.
 - a. Pure, by surfaces of blood or bone.
 - b. Partial, by depressed edges or spiculæ, the symptoms being incomplete and marked by signs of irritation.

(*To be continued.*)

ON CERTAIN PHYSIOLOGICAL AND OTHER FACTS

OBSERVED DURING THE

TREATMENT OF SPINAL DISEASE.

By SAMUEL HARE, Esq., M.R.C.S.

(Read before the Provincial Medical and Surgical Association, at the Annual Meeting, held at Worcester, August 2nd, 1849.)

It is not my intention on this occasion to enter into particulars as to the various forms and modifications of spinal disease, or the different plans of treatment they require; these I have had opportunities of referring to, when detailing the particulars of several cases, in papers which I have had, on former occasions, the honour of reading before the Association.

My object at present, is to lay before you certain facts, partly of a physiological character, but mainly relative to the improvement which takes place in the general health of patients during the progress of the cure of spinal deformities—facts which have repeatedly come under my notice during the many years I have specially directed my attention to the treatment of this class of diseases.

On the importance of physiological inquiries, I need scarcely insist, for assuredly physiology is one of the most interesting topics connected with our profession, being the basis on which we ought to rest, and the guide to the direction in which we should turn our attention, with a view to improve health, and, consequently, to prolong life, and by which we may introduce more of certainty into our practice.

In all cases of spinal deformity, even where the disease has attained only a *moderate* degree of severity, there is a certain amount of deformity of the chest consequent upon an alteration in the shape or direction, or both, of the ribs; each case may present some minor varieties, in the deformity of the ribs, just as the spine, in each case of lateral or other species of the disease, presents certain differences from other instances of the same class. But, speaking generally, the particular state of the ribs is determined by the kind of deformity with which the spine is affected; thus, in angular projection of the dorsal region, the ribs are compressed laterally, and the sternum projects forwards; in ordinary lateral curvature the ribs of the right side are rounded and projecting, while those of the left are compressed; in other cases the intercostal spaces are diminished, and the muscles very much wasted. All these changes, however, of the ribs from their natural position and direction are attended with certain effects in common,—their own motions are interfered with, they compress unnaturally, and often cause a displacement of, the thoracic viscera, so that, in some instances, the apex of the heart is found beating vertically below the middle of the left axilla; and in severe cases these deformities of the ribs have a similar effect, and to a very considerable extent, upon the viscera of the abdominal cavity, while the great vessels, situated upon the anterior aspect of the vertebræ, are twisted and bent in the same direction as the deformed spine.

As a consequence of these conditions, some of the most prominent symptoms, in advanced states of the cases under consideration, are—

1st. An impeded circulation of the blood through the lungs and other viscera.

2nd. Considerable difficulty in breathing, frequently attended with a cough.

3rd. An almost uniformly congested state of the digestive organs, producing want of appetite, indigestion, &c.

On the subject of the first effect, viz., the state of the circulation of the blood, it is obvious that as this fluid is necessary to nourish and sustain every part of the body, and as from it all the secretions are derived, anything which interferes with its due distribution must be very prejudicial to health. No better adaptation of means to an end can be conceived than that of the heart and arteries to the purpose for which they are intended; but if we take into consideration the curved state of many spines, and the similar state of the large vessels going to and from the heart—if we further consider the contracted state of the chest in such cases, with the necessarily impeded state of the circulation of the blood, we must at once see the injurious effects which pressure, either partial or general, upon the chest and abdomen, must have upon the general health. A due arterIALIZATION and a free circulation of the blood being necessary for the healthy performance of the functions of life, it is not surprising that, in patients affected in the manner I am describing,—lassitude, languor, and all their concomitants should be present, and all the functions be disturbed.

It is well known that the blood circulates more frequently in persons of a sanguineous temperament, than in those who are phlegmatic—and conversely, where in a person of a sanguineous temperament, the circulation becomes from any cause impeded—he loses the energy characteristic of his temperament: so, in cases of spinal deformity, the sanguineous temperament is rarely or never met with, the patients being or becoming almost always either of a phlegmatic or of a nervous temperament.

The return of the blood to the heart being interfered with, congestive headaches, sometimes of long duration and very severe, are usually met with in cases of this kind; the nervous system indeed, generally, is much affected, there being in some cases, great mental irritability; while, in others, the feelings are exceedingly depressed, in which case a great degree of torpor and inactivity prevails.

The mode in which deformities of the spine and chest interfere with the motions of respiration—a function most closely associated with that of the circulation of the blood—will at once be comprehended. In ordinary and natural inspiration, the intercostal muscles and diaphragm are contracted, while the abdominal muscles are relaxed; by these means the diaphragm is drawn downwards, and rendered less convex towards the chest, and the ribs being raised upwards, the cavity of the chest is enlarged. In making a deep inspiration, several other muscles, as the *scaleni*, the *serrati*, the *pectorales*, and the *latissimus dorsi*, &c., also assist, so as to produce a greater effect than in ordinary respiration; thus the ribs are more forcibly raised and the chest is expanded outwards to a greater extent,—the shoulders and other parts being used as fixed points.

In expiration, the reverse action takes place; the abdominal muscles are contracted, while the diaphragm is relaxed. By these means, aided by the important circumstance of the elasticity of the cartilages of the ribs, the ribs are drawn downwards, while the diaphragm is rendered more convex; thus the cavity of the chest is diminished, the lungs are compressed, and the air, or rather part of it, is expelled through the trachea; the more powerful the contraction of the abdominal muscles, the more powerful will be the expiration.

But, when any considerable deformity has occurred, these natural respiratory movements can no longer be efficiently performed; in severe cases, indeed, the heads of some of the ribs become firmly ankylosed to the vertebrae,—in lateral curvature, this especially occurs along the concavity of the curve—so that the only motion admitted of, is that of the elasticity of the cartilages. In lateral curvature, again, on the one side of the chest, the edges of the adjoining ribs come so nearly into contact that the intercostal spaces are almost obliterated, and the intercostal muscles, therefore become atrophied, and almost useless so far as respiration is concerned; while, on the other side, the intercostal spaces are of unnatural width. Again, in some cases, an angular projection of the spine especially, the thorax is tilted forwards, so that the diaphragm presses

upon the abdominal viscera, and its descent in the process of inspiration is interfered with; while from their lateral compression, and from their having lost their natural and graceful curve, the proper expansion of the ribs is at the same time prevented. Thus, while by the natural action of the respective parts of the chest, its expansion is increased in every direction, when the individual is in health, and the respiration is performed without any exertion, (the diaphragm being the chief agent,) in deformities of the chest, respiration is performed both with difficulty and often very imperfectly.

It is almost needless to refer to the importance to the animal economy of a due performance of the respiratory functions, nor need I do more than mention a few of the symptoms usually met with in cases of spinal deformity to show the injurious influence which deficient respiration exerts in persons thus affected.

Allusion has already been made to the disorder of the circulation induced by deformities of the chest, and the function of respiration is so intimately connected with the circulation of the blood, that the latter is still further interfered with by the derangement which the former suffers in these cases: thus there is ordinarily present in cases of spinal and thoracic deformity a certain amount of dyspnoea, with palpitation of the heart, which are often from an inconsiderable degree of exertion, so much increased as to be truly distressing; hence, congestion of the lungs is not unfrequently produced, accompanied with a certain amount of cough, which, in some instances, becomes more or less constant.

Free and natural respiration is necessary for the due arterialization of the blood,—for those changes in it which are required in order that the nutrition of the body may go on healthily—that the secretions and excretions which are eliminated from it may be of a normal character—and that the natural temperature of the body may be maintained; but in such cases as I am referring to, the defective arterialization and the deficiency of the circulation of the blood are obvious by the somewhat livid or bluish appearance of the complexion which is often present on exertion, and the coldness of the extremities and frequently of the body generally, which is complained of; while the delicate appearance usually presented by this class of patients may probably be referred, in a great measure, to the imperfect manner in which the necessary chemical changes take place; as may likewise the fact, that when the disease progresses considerably, the growth of the body is frequently arrested, or at least suspended; dependent also, probably, upon the contracted state of the chest, is the peculiar character of the voice, not unfrequently met with in cases of deformity.

Nor can it be any matter of surprise that such extensive mischief should ensue from pressure thus produced upon the thoracic viscera, when it is understood *how much* their natural functions and healthy actions are interfered with. With respect to the heart, the interference can only be estimated approximatively; with regard to the lungs it can actually be measured by ascertaining the number of cubic inches of air which a patient can expire, and comparing that with the amount

expired, on the average, by persons of similar height, in the enjoyment of good health and free from deformity. Such measurements I have long and frequently made by means of the pulmometer (an instrument described in my work "On Spinal Disease,") and have found that the breathing capacity is often deficient to the amount of 40 or 50 cubic inches, or even considerably more than this; and in one case of excessive deformity, which I shall presently again refer to, the deficiency amounted to 65 cubic inches.

The effect of considerable deformity in producing unnatural pressure, and consequent disturbance of function, extends, as has already been hinted at, to the abdominal viscera, which, like those of the chest, are very apt to become congested; under these circumstances the liver becomes inactive and its secretions unhealthy, the bowels constipated, digestion goes on imperfectly, and the chyle formed for sanguification is therefore of an unhealthy quality, so that the blood, being originally derived from the chyle, also partakes of the same unhealthy character, whence result in a great measure, the debility and inaction—the loss of muscular activity, with the languor and listlessness which are the usual concomitants of spinal deformity. The healthy action of all parts of the body being thus dependent upon one another, it is obvious how the most injurious effects must follow when so much pressure is made upon organs which are necessary for the continuance of life and even the maintenance of health.

As I stated at the commencement of the paper, the object I have had in view has not been to enumerate all the symptoms of spinal disease, and much less to mention the various complications which may accompany it; I should, otherwise, have had to dwell upon the *secondary* effects which it sometimes produces on the nervous system—the great irritability which it causes in some cases—the muscular contractions on the one hand, or the paralysis on the other, which it may give rise to; I should have had to speak of the various abscesses which sometimes occur, and of many other points, which would have prolonged my paper much beyond the limits I intended, besides being foreign to the subject which I wished to bring more immediately under your notice, viz., those effects which result from the unnatural pressure caused by spinal deformity upon the viscera of the chest and abdomen, and which effects, being so dependent, almost immediately disappear as the deformity itself is relieved by treatment. Neither does time allow that I should enter into any details of the plans of treatment which the different forms of spinal disease require, and it is perhaps the less necessary for me to do so at present, as I have had opportunities, on other occasions, of entering on these subjects when speaking of individual cases, as well as in my work on the disease; I may, however, so far trespass on your time as to state, that recumbency almost always forms an important item in the plan of treatment I adopt, together with the removal of the weight of the head and shoulders from the deformed spine by means of slight, but, from time to time, gradually increased extension, employed at the same time with the recum-

bency; besides which, at intervals during the day, a certain amount of pressure is applied, partly by means of compresses attached to the plane on which the patient reclines, and partly by friction with the hand to the projecting parts, in such a direction that its tendency is to bring the deformed parts towards their natural position, and to remove that *unnatural* pressure which is exerted by them upon the internal organs.

Amongst the earliest points of improvement noticed by almost all patients, as their deformity becomes relieved, are, the loss of their former dyspnoea and their much greater freedom of breathing; these are dependent upon the greater ease with which the movements of respiration are performed, owing to the ribs assuming more of their natural shape and position, and to the action of the diaphragm being facilitated by the removal of the pressure from the abdominal viscera. I have noticed in a preceding part of this paper, the fact of the breathing capacity of deformed persons being considerably below the standard of health; and I may here add, that as the patients improve in their deformity, their breathing capacity approaches more and more towards the healthy standard. Thus, in a young lady from the north of England, aged 17, affected with lateral curvature, the breathing capacity increased in nine months 52 cubic inches, viz., from 78 to 130; in another case the capacity was augmented from 62 to 100 in three months; and in a third, from 100 to 150 in twelve months. A young lady, aged 16, with long-standing and very severe lateral curvature, combined with excurvation, when she came under treatment, measured 4 feet 6½ inches in height, weighed 5st. 9½lbs., and could expire *only* 30 cubic inches of air; at the end of little more than eleven months her height had increased to 4 feet 8½ inches, her weight to 6st. 2lbs., and her breathing capacity to 69 inches, being an increase of 39 inches. Another, aged 13, within five months increased 1½ inches in height, 13 lbs. in weight, and 27 cubic inches in the capacity of the chest. And, to add one more, and a very remarkable case, that of a patient, aged 23, who was exceedingly distorted from rickets; her height, which was only just 36 inches, increased, within twelve months, more than 5 inches, and her breathing capacity, which was ascertained at intervals of about a month, increased gradually from 25 cubic inches, which was the utmost she could at first expire, to 51, 71, 79, 83, and 90 cubic inches respectively, showing a total increase of 65 cubic inches. Such an alteration having taken place in the capacity of the chest, it may readily be conceived how it is that the difficulty of breathing, complained of in cases of deformity, is usually so much relieved at the same time the deformity is remedied; the circulation also becomes more regular, and the palpitations less troublesome, in proportion as the heart's action is less interfered with, in consequence of the improvement in the shape of the chest.

At the same time that the breathing improves, the patients usually lose the troublesome, though not severe, cough with which many of them are affected; and as the pulmonary circulation becomes freer, and the blood better oxygenated, and therefore better fitted for its

important functions, the coldness of the extremities, so generally a matter of complaint with this class of patients, disappears. It is also, probably in a great measure, owing to causes of this kind that the headaches are likewise so much ameliorated, though that result is doubtless also partly dependent upon the improvement which ensues in the condition of the digestive organs. That the imperfect manner in which the latter discharge their functions, and that the general torpor of the alimentary canal are much owing to the pressure to which they are subjected in cases of deformity, I feel no doubt; and I am equally convinced that the improvement which takes place is, in a great measure, due to the removal of this injurious pressure, though the exact extent to which this cause acts may be somewhat difficult to determine, as attention to the general health is combined with the treatment necessary for the relief of the spinal disease. The combination of local and general treatment is most conducive to the welfare of the patient, and indeed is essential to it, but renders it a difficult point to eliminate from the other the amount of merit due to each part of the treatment, so far as regards the improvement which takes place in the digestive apparatus.

When spinal disease takes place during the period of growth, it is not unusual for this to be arrested, or at least for its progress to be materially diminished, so that deformed persons are often not only so much less than they ought to be, by that amount which would be accounted for by the actual shortening of the spinal column, but the rest of the body is frequently smaller and shorter than it would otherwise have been, as may be witnessed almost every day in our streets, and as I saw well marked, last week, in the case of a patient who consulted me, whose height, though she was 22 years of age, was only 51 inches. Now, there is this remarkable circumstance attending the treatment of such cases, if it occur during the period of growth, that, after the deformity is relieved, not only does the process of growth often recommence, but nature sometimes appears to make an effort, if I may use the expression, to compensate for lost time, for not only have I frequently known young persons who had grown but little or none at all for some time before treatment, commence doing so afterwards, but in some cases the growth has been so rapid as apparently to be explicable only on that supposition; thus, a young lady aged seven years, whose growth had been arrested for some time before I saw her, increased, during the time she was under treatment, 2½ inches, and in the fifteen months subsequent to her return home, no less than five inches.

Theoretical objections are sometimes urged against the use of the recumbent position for the treatment of spinal deformity, under the supposition that it may be injurious to the general health; I would answer that a careful study of the pathological condition of the parts affected in cases of angular projection, and, indeed, wherever caries, (or softening of the vertebræ, as in some cases of lateral curvature,) exists, would show it to be the only rational plan—the only one likely to insure permanent success; and experience, which is

after all our best and surest guide on such subjects, tells plainly that, so far from patients suffering from it, when it is rightly employed, and when attention is at the same time paid to the digestive organs and the general state of the system, they *uniformly* improve in health, and get stouter.

As I stated, it was not my intention to have illustrated this paper by the detail of any case, but having at present two under treatment of so interesting a character, and so much to the point, I feel it desirable to notice them. One of them is the case of a young lady, aged 16, who, besides labouring under lateral curvature, has also suffered from a destructive ulceration of the nose (lupus,) during the last eight or nine years; it first commenced on the outer side of the right ala, near its point of junction with the upper lip. From that time up to last Christmas it had made gradual, though not rapid progress; the ulceration during that period had extended to the end of the nose, which was itself enlarged and indurated, while a small portion of the right ala had been eroded. She came under my care in March last, and in the interval between Christmas and that time, the progress of the case had been much more rapid, notwithstanding every pains, during its whole course, had been taken to arrest the disease. When I first saw her the greater part of the nose was red, hard, and painful, the ulcerative process had extended to both alæ, a portion of which, especially the right one, together with the end of the nose, were destroyed, while the only portion of the lower part of the septum which remained, was that part of it united with the upper lip, over which it partly hung. I have pleasure in stating that, besides the patient being relieved of the spinal affection, the ulceration is now entirely healed, the remaining portion of the septum having been supported in its natural position by a small compress and strips of adhesive plaster, and is now united and healed there. In this case the recumbent position was deemed absolutely necessary, alterative aperients were prescribed, together with occasional saline purgatives, while the nose was poulticed twice daily, care being taken to support the septum as before mentioned. Blisters, as counter-irritants, were occasionally applied to the part. Neither arsenic nor iodine in any form were prescribed, nor mercury, except as an occasional purgative.*

The other case is that of a young lady, aged 25 years, and resident in the county of Kent, affected with lateral curvature and a high degree of spinal irritation. She had always been from childhood exceedingly delicate, but much worse since she had a severe attack of inflammation of the brain, six years ago. This left her in such a state of weakness that she had not been able to walk at all since, nor even to use her hands sufficiently for writing, not having written a note from that time to coming under my care. In this case the use of the recumbent position (with other remedies as are more particularly detailed in my "Practical Observations,

* Drawings of this case, one taken prior to my seeing the patient, and the other a few days before I read the paper, were exhibited at the meeting.

&c.,") was equally necessary, as in the preceding instance, and the results have equalled my warmest expectations. Although it is not yet two months since she commenced treatment, she is able, with the assistance of her mother and sister, to pace the room comfortably. Her spirits, which were much depressed, have become excellent, and she has recommenced correspondence with her friends.

ON THE USE OF THE PROBANG.

To the Editor of the Provincial Medical and Surgical Journal.

SIR,—I feel much obliged to Mr. Morgan for the interesting case he has so well narrated in the last number of your valuable journal, and as I once met with a case that might have terminated unfavourably by my own hand, I beg leave, with all due deference to that gentleman, to offer the following remarks.

Yours obediently,

WM. NORRIS, M.D.

Stourbridge, October, 1849.

About twenty years ago, Samuel Haywood, aged 60, of Whittington, near this town, came to me, and said he had swallowed a large bone, which stuck low down in the œsophagus, and gave him great pain. He had taken a hasty repast from a neck of mutton. I introduced the probang, which was obstructed by a firm substance that resisted the farther introduction of the instrument. I was young, perhaps adventurous or rash, for I repeatedly and very forcibly pushed downwards the instrument; at length it passed into the stomach, and I found to my great dismay I could not withdraw it, but after several attempts up came the bone followed by the probang, and I have not yet forgotten the shudder—from the appearance of so large a bone, together with the suffocating effects on the patient—that came over me. The bone was nearly an inch and a half in length, and its base nearly as thick as my smallest finger, the point sharp and nearly triangular. The man suffered severely, but slowly recovered, and many of his children are alive, and well remember the accident.

By these violent efforts I might have forced the bone into or through the coats of the aorta, and sudden death might have followed—a very unpleasant dilemma for a young practitioner. This case clearly points out the propriety, when large and sharp bones are swallowed, of a consultation with a senior practitioner.

If this bone, which from its size, must have remained firmly transfixed across the œsophagus for a considerable time, what might have been the consequence?—first, urgent distress; and secondly, if its sharp spicula had been in close contact with the aorta, the action of so large a vessel, from its frequent and regular pulsations, would have soon set up an ulcerative process in its coats, and a fatal hæmorrhage must necessarily have followed. This case shows the necessity of introducing the probang;

and should the operation, together with the convulsive efforts of the œsophagus, force the bone through the artery, the surgeon has done his duty, however unpleasant that duty might have been, for it is most likely that a fatal termination must have ensued by nature's own processes.

The coats of a large artery like the aorta, are so thick and firm, it would be no easy matter to tear or cut through them when filled with a yielding fluid, like blood; and I think very few patients would be satisfied to suffer intensely many days, knowing a foreign body to be lodged, without sending for a variety of practitioners, and perhaps some young aspirant may, with good luck in the operation, clip the wings of a far-famed senior.

If a bone punctures the outer coat of the aorta, then there would be great risk in interference, but even then the only chance would be, the removal of the foreign body, for the external laceration may, by loss of blood and low diet, heal. If a bone penetrates fairly into the artery, then it would be unwise to remove it. But how are we to know this? In fact we shall never be able to prove it; but we may presume, which is most probable, that death would in most cases speedily take place, unless the wound be exceedingly small. I am inclined to believe, that the constant succession of so large a stream as passes through the aorta, would soon disentangle a foreign body.

But to analyze Mr. Morgan's remarks more minutely, which I wish to do with all good nature, but in the cause of science most freely, which I am certain that gentleman will allow to be quite necessary in a case involving so many interesting points.

Is it not probable that the first hæmorrhage occurred from some of the vessels of the œsophagus, or its vicinity? for hæmorrhage once having taken place from a wound in so large an artery, so many days after the accident, the frequent pulsations must preclude all hope of that hæmorrhage ceasing for forty-eight hours. The bone once loosened by ulceration, the frequent impulse from such a stream would necessarily disentangle it very speedily; it is possible that the bone may have penetrated the first coat of the artery, or I am more inclined to believe, (and the size of the wound favours the idea,) that as the spicula was in contact with the artery, thus irritating the coats, an ulcerative process would be slowly set up, and occasion death. In violent cases we are justified in adventuring with our remedies in medicine, and in surgical cases with our instruments, or many lives would be lost; but we must adventure with the greatest caution.

I do not think in the act of deglutition the force would be sufficient, first to pass the bone through the œsophagus, and then through the artery, or even to pass through the artery alone.

Many years ago an old surgeon in this town broke a probang in an old woman's œsophagus, and she died next day. I requested Mr. Weiss to make an instrument that would not break, and I shall request my zealous and excellent friend, Dr. Hastings, to exhibit it at the next meeting.