to state, the lungs in cholera are comparatively free from disease, yet it has occasionally, and sometimes not infrequently, been observed that emphysema has resulted from this remarkable prolongation of the inspiration during collapse. Majendie, in directing special attention to the frequency of its occurrence during the cholera epidemic of 1832, remarked that it was rare not to meet with it in those cases in which death had occurred at the end of thirty to thirty-six hours. Jackson has also recorded the occurrence of emphysema in Paris at the same date, in no less than eight cases out of twenty-five, in persons dying without reaction. Dr. Morehead, of Bombay, observed it in seven out of twenty cases; and confirmatory evidence has been published by Dr. Parkes, Professor Virchow, and very many other observers. The emphysema which is thus liable to occur during choleraic collapse, is the physical result of an exceptional prolongation of the inspiration, which leads to over-distension and rupture of the air-vesicles. The tendency to rupture in such cases as these, in which there is prolonged and recurring over-distension with air is greatly favoured by the reduction in the amount of blood which is sent to the lungs for aëration, and which is so much reduced during collapse that Professor Griesinger has been able to demonstrate that the area of cardiac dulness is less than the normal extent, and that consequently the blood in the pulmonary artery and its branches is comparatively very small in amount. There should, therefore, be very little, if any, difficulty in recognising the fact when the air-vesicles, which expand with each normal inspiration, have been exceptionally distended in consequence of the inspiration having been exceptionally prolonged; and that when, at the same time, they have been to a great extent deprived of that soft and much needed support which only blood in the pulmonary capillaries could give, there must be a great and a long-recurring tendency in their yielding and bulged parietes to burst. It is now fairly well acknowledged that, as regards the natural history of disease, it behoves us from time to time not simply to take stock of the knowledge we possess, but also to test its value; for unless some efforts are occasionally made to separate, as it were, the corn from the chaff, many false facts in connection with false theories of disease would continue to occupy the place of much that is important and capable of being well proved in medical science.

It has been chiefly through the influence of chemistry on the scientific investigation of cholera that many false facts as well as false theories have been swept away, and, in consequence of the clearance which has been thus effected, it has become possible for us to recognise the true nature of the disease. But we must not too hastily allow ourselves to suppose that because something more is now known about cholera than was formerly the case, it has become more easy to discover its true cause, or to undertake, with any increased confidence, its treatment. There is a very noticeable agreement in the results obtained from its clinical, its chemical, and its pathological investigation, which unmistakably indicates that cholera is due to a central arrest of nutrition, and which has been fully confirmed by biological research.

Notwithstanding, however, the great advance which has been made in our knowledge of the nature of the disease, the problem of its cure, like that of its cause, remains unsolved. For although there are fortunately many cases in which this central arrest of nutrition appears to be only a temporary condition, from which there is a more or less strongly marked tendency to recover, yet there are other and very numerous cases, which in some epidemics of the disease represent a small but still a decided majority, in which there is practically very little or almost nothing that we can do but to stand by and watch whilst the great centre of organic life totters, as it were, to its fall.

Although we are thus compelled to take what it must be admitted is a very gloomy view of the nature of the disease, yet there is much that may notwithstanding be regarded as hopeful in some of the results of its scientific investigation. For we have been enabled, and especially through the influence of chemistry, to recognise more fully than would otherwise have been possible, the greatly increased efforts which are made by the curative power of Nature to maintain life, when, to the superficial observer, the tendency to death appears to be most marked. In one of the numerous cases cited in my now well-known paper on the "Chemical Pathology of Respiration in Cholera," it was analytically proved, during some hours of well-marked collapse, that whilst the average quantity of carbonic acid eliminated from the lungs was only 37 per cent., the average quantity of oxygen ab-

sorbed was 54 per cent. of the normal amount, and that when the final analysis of the expired air was made one hour and ten minutes before death, and when the cyanosis was strongly marked, the carbonic acid eliminated was only $5\frac{1}{2}$ per cent., whilst the oxygen absorbed was 29 per cent. of the normal amount, or, in other words, the oxygen absorbed was equal to nearly six times the carbonic acid eliminated. No evidence could be more conclusive than this, for it proved that the comparatively large amount of oxygen received by the pulmonary blood in choleraic collapse is due to the exercise of this curative power in Nature, and that during the struggle to avert death, oxygen necessarily becomes more and more entitled to be regarded as the breath of life, and that it is admitted as such in relatively increased quantities into the blood through the lungs. But whilst a comparatively large excess of oxygen can be thus abstracted from atmospheric air for the purpose of warding off impending death, it has been experimentally demonstrated that the addition of artificially prepared oxygen to the air for inhalation has very little, if any, influence on the amount absorbed. For it has been fully proved that the relative quantity of this gas which is exchanged for carbonic acid during health is not greater when an excess of such oxygen has been added to the air; and, consequently, all attempts to overcome the collapse of cholera by inhalations of chemically prepared oxygen have signally failed in every outbreak of the disease. This failure is undoubtedly due to the fact that, apart from any necessity there may be for distinguishing between the physiological and the chemical affinity of living structures for oxygen, there is an essential distinction made by the lungs, both in health and in disease, between natural and artificially prepared oxygen; so that whilst the latter is almost, if not altogether, rejected, the former is more or less readily absorbed. The exercise of such power of selection is the more remarkable as it is evident that there must be greatly increasing efforts made during advancing collapse to secure a relative excess of natural oxygen from the impoverished air within the air-vesicles; for such air progressively retains comparatively more carbonic acid and less oxygen than that of the surrounding atmosphere.

In conclusion, it may be remarked that although the influence of chemistry on medical science, as illustrated by cholera, has been very great, it has not as yet been fully recognised. As time, however, goes on, it may be expected that there will be increasing reluctance to accept any theories of disease which are based on chemical assumptions, unless they are supported by the evidence of chemical analysis, since it has been clearly demonstrated that one analysis of the expired air is sufficient to disprove all theoretical connection between cholera and defective oxygenation of the blood.

A BRIEF STATEMENT OF THE CAUSATION OF SEVERAL OF THE SIMPLE AND RACHITIC DEFORMITIES THAT DEVELOP DURING YOUNG LIFE.¹

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IN this communication I wish to state as briefly as possible the conclusions at which I have arrived from a study of the causation of many of the deformities which arise in early life.² I will divide them into two groups, one comprising the simple deformities, as flat-foot, knock-knee, lateral curvature, and dorsal excurvation, and the other such rickety deformities as dorsal excurvation of infancy, or rickety spine, bow-legs, rickety knock-knee, and lateral curvature.

The causation and pathology of the first group are comprised under the following statement, namely, that each is first the fixation and subsequently the exaggeration of a normal physiological attitude of rest. While a vigorous child when in the erect or sedentary posture assumes attitudes of rest but rarely, and then for very short periods of time, preferring attitudes of activity, a feeble child habitually and for considerable periods of time re-

¹ Presented to the Section of Diseases of Children at the Annual Meeting of the British Medical Association held at Glasgow, August, 1888.

² *Guy's Hospital Reports*, 1886-87.

tains its several joints in such resting postures. By the position of rest of a joint I mean to indicate its condition when the individual assumes the easy erect attitude, and by means of which the superjacent weight is transmitted through it with the expenditure of a minimum of muscular energy, the bones and ligaments being so arranged as to sustain as much of it as possible; and by the position of activity of a joint I mean the condition in which it exists when the active erect posture is assumed. The latter entails the expenditure of a considerable amount of muscular energy.

I will pass on now to the consideration of the several deformities. The mechanism of the ankle-joint is such as to permit only of rotation of the astragalus around a transverse axis. Any rotation of the astragalus around a vertical axis is so slight that for practical purposes it may be regarded as not being possible.³ Movements of rotation of the foot around an antero-posterior axis take place in the subastragaloid joint, and to some extent also in the calcaneo-cuboid articulation. Adduction of the foot, or, as it is commonly called, inversion, is produced chiefly by the action of the tibialis posticus muscle and to a lesser degree by that of the tibialis anticus. The tibialis posticus raises the tubercle of the scaphoid, so rendering the oblique fibres of the calcaneo-scaphoid capsule more transverse and approximating the bony attachments of the superior internal and inferior calcaneo-scaphoid ligaments. The strain sustained by the fibres of the capsule raises the sustentaculum tali and rotates the os calcis around an oblique antero-posterior axis passing through the length of the astragalus. The tibialis posticus assists directly in the production of this rotation by means of its important insertion into the lesser process. The head of the astragalus is displaced outwards on to the greater process of the os calcis by the tense fibres of the superior internal calcaneo-scaphoid ligament and by the pressure exerted upon it by the tendon of the tibialis posticus, the forcible approximation of the sustentaculum tali and scaphoid displacing it backwards upon the os calcis. By this means the inner arch of the foot is raised and the inner margin of the foot is shortened. The rotation of the os calcis around an antero-posterior axis produces a separation of its articular surface from the corresponding concavo-convex facet upon the cuboid, and this being opposed by the powerful plantar ligaments, the outer arch is raised considerably. The fibres of the short plantar ligament are also rendered more transverse by the inward displacement of the cuboid.

The tibialis anticus, by its insertion into the centre of the inner arch, assists in rendering it more convex. In Figs. 1 and 2 I have represented the foot in the act of adduction, and in Figs. 3 and 4 in that of passive abduction or of rest. x indicates the calcaneo-scaphoid capsule, y the long plantar ligament and z the short plantar ligament. Active abduction of the foot, or, as it is

Fig. 3.—The foot in position of abduction or of rest.

Fig. 4.—The foot in position of abduction.

more commonly called, eversion, is produced by the action of the peronei muscles. The mechanism of active abduction will be obvious from a consideration of passive abduction, to be considered immediately.

In the active erect posture the bare foot is retained in a position of partial adduction, while the booted foot assumes an exaggerated position of adduction, the amount of which varies directly as the height of the heel of the boot exceeds that of the sole, or, in other words, as the angle formed by the inclined plane upon which the foot rests with the horizontal plane.

When the easy erect posture is assumed, the bare foot is retained in a position of passive abduction, while the booted foot assumes an exaggerated position of passive abduction, the degree of abduction varying directly as the height of the heel exceeds that of the sole of the boot. In passive abduction of the foot the tibialis posticus and anticus muscles are relaxed, the tubercle of the scaphoid sinks, that bone rotating around an oblique antero-posterior axis, the calcaneo-scaphoid capsule is relaxed, its fibres assuming a more longitudinal direction, the os calcis rotates around an antero-posterior axis, the sustentaculum tali descending, owing to the relaxation of the calcaneo-scaphoid capsule and tibialis posticus muscle, the astragalus glides downwards, forwards, and inwards upon the inclined surface of the os calcis, and occupies the increased interval between the sustentaculum tali, pressing against the superior internal calcaneo-scaphoid ligament, and rendering the inner arch convex inwards. The inner arch is depressed and elongated, and if the boot be short the great toe impinges against its extremity. The cuboid is rotated around a vertical axis upon the os calcis, so that these bones form an angle open outwards. For the same reason the plantar ligaments are relaxed and the outer arch depressed. The extremity of the outer malleolus comes into contact with the outer surface of the os calcis.

It is obvious that in passive abduction of the foot stress is sustained by the opposing surfaces of fibula and os calcis, by the upper and outer portions of the calcaneo-cuboid joint, by the lower portion of the calcaneo-scaphoid articulation, by that portion of the surface of the head of the astragalus, which, in this position, exerts an enormous pressure upon the elongated calcaneo-scaphoid ligament, and by the opposing articular surfaces of the metatarsal bone and phalanx of the great toe, should the boot be too short for the foot in this condition. Therefore, if this posture is assumed habitually for long periods of time, it is in these situations that pain is experienced, and that pressure-changes ensue.

I think I have said enough to prove my statement as regards

Fig. 1.—The foot in position of adduction or of activity.

Fig. 2.—The foot in position of adduction.

³ Movements of the Ankle-Joint, *Journal of Anatomy and Physiology*, April, 1888.

flat foot. I will now pass on to the consideration of the causation of simple non-rachitic knock-knee.

Fig. 5.

Fig. 6.

In the active erect posture a plumb-line dropped from the upper surface of the head of the femur falls through the external condyle and the opposing surface of the head of the tibia. In the easy erect attitude the plumb-line falls outside the external condyle.

Fig. 7.

Fig. 8.

In the easy erect posture the plumb-line falls in front of the transverse axis of rotation in the knee-joint, which is retained in a position of over-extension, therefore the opposing surfaces of

tibia and femur in front of the transverse axis of rotation sustain more pressure than do those behind it. In this attitude there are present tendencies to the diminution of the external and anterior femoro-tibial angles, and to the displacement of the patella outwards upon the external condyle. If this attitude be assumed habitually for long periods of time, these tendencies become progressive actualities, producing the various degrees of simple knock-knee.

I have indicated in Fig. 5 the mechanical conditions which exist in the active erect posture, and in Figs. 6 and 7 those present in the easy erect attitude. Fig. 7 represents the knee-joint, the dot the axis of rotation, the firm line the traction exerted by the ligaments opposing over-extension, and the line falling in front of the knee-joint, the force producing complete extension.

In Figs. 8, 9, and 10 I have represented progressive conditions

Fig. 9.

Fig. 10.

of simple knock-knee, an examination of which will show their obvious causation. The normal curves in a vertical antero-posterior plane, and the variations in the form of the bodies and fibro-cartilages of the spinal column, represent the fixation of such simple curves as result mechanically from the habitual assumption of the sedentary and erect postures; or, in other words, from the habitual retention of the rigid base upon which the series of bony and fibro-cartilaginous segments are supported (namely, the superior articulating surface of the sacrum) in such an oblique plane as necessitates their formation. The degree of obliquity of the plane of the facet on the upper surface of the sacrum, and, consequently, the amount of convexity of the superjacent curves varies occasionally. For instance, in cases of fusion of the fifth lumbar vertebra with the sacrum, the plane of the articular facet upon the upper surface of the sacrum approximates more nearly to the horizontal than it does in the normal subject; while in cases of dissociation of the first piece of the sacrum the reverse holds good.

The degree of convexity of these normal curves is capable of being exaggerated considerably when the subject, while in the sedentary or erect attitude, retains the trunk in the resting posture upon a symmetrically placed pelvis. While in such a position of rest, there exist tendencies to the diminution of the depth of the portions of the bodies of the vertebrae forming the concavities of the curves, to the increase of the depth of those portions of the bodies which form the convexities of curves, and to the forward and downward displacement of the upper portion

of the sacrum, producing a diminution in the conjugate diameter of the pelvic brim.

If a subject assumes habitually, and for long periods of time, such a resting posture, these tendencies become actualities, the exaggerated convexities becoming fixed, and the condition commonly called dorsal excurvation being developed. As in the other deformities much of the acquired change in the form of the bones is due to the variation in the normal rate of growth of the several portions of the growing line under the influence of abnormal pressure.

I have represented in Fig. 11 the outline of the column in the

Fig. 11,

Fig. 12.

active erect posture, and in Fig. 12 a similar outline of the column of a subject in which the easy, erect posture had become a fixture, producing the condition called dorsal excurvation of young adult life. The plane of the facet on the upper surface of the sacrum is indicated in either case by a firm line.

Fig. 13 shows the changes in form which the dorsal vertebræ and fibro-cartilages undergo in a well-marked instance of this resting deformity. The rickety infant, unable to walk till a comparatively late period, assumes habitually a sedentary attitude, the head and neck and thorax being thrown forward in a sprawling position of rest. If a healthy, active child be observed while in this attitude, the spinal column is seen to form a long single curve upon the sacrum, the lumbar spine being flexed upon the sacrum, and the sacrum upon the iliac bones. In the rickety infant the thorax is flexed forcibly upon the lumbar spine, producing a more or less abrupt prominence at the junction of these two portions of the columns, the condition being commonly described as rickety spine. An examination of such a deformed rachitic infant shows that the anterior portions of the bodies of the last two dorsal and upper two lumbar vertebræ are much compressed vertically, and that the fibro-cartilages project forwards considerably from between them; also that the sacrum has yielded in such a manner that its promontory is displaced forwards and downwards from its normal position, and the conjugate diameter of the brim of the pelvis is more or less considerably diminished. The posterior portion of the iliac fossa may also be

Fig. 13.

rendered abruptly more concave by a curling inwards and forwards of its posterior margin. The condition is commonly termed rickety spine, or dorsal excurvation of infancy.

I have represented diagrammatically in Fig. 14 the conditions

Fig. 14.

presented by a healthy, vigorous child while assuming this seden-

tary attitude, and in Fig. 15 those existing in a case of rickety spine.

Fig. 15.

When this deformed infant attempts to stand erect, the displacement of the lumbo-sacral articulation forwards from its

Fig. 16.

normal relationship to the acetabular cavities necessitates an excessive rotation of the pelvis around a transverse axis, in order that

Fig. 17.—A indicates the head; A C the spinal column; D E the thigh; E F the leg.

the lumbo-sacral joint may be displaced sufficiently backwards to be brought into a suitable working relationship with the hip-joints in this posture. Very great strain is thrown upon the ilio-femoral ligament and upon the anterior portion of the capsule by this exaggerated movement of pelvic rotation, and an apparent flexion of the thighs upon the pelvis is produced, the knees and ankle-joints being flexed through a corresponding angle. It is obvious that, owing to the permanent flexion of the lumbar spine upon the pelvis produced by the yielding of the sacrum, though the thighs are flexed upon the trunk, they are over-extended upon the pelvis.

I have represented in Figs. 16 and 17 the mechanical conditions presented by the normal skeleton of a subject in the erect posture, and in Figs. 18 and 19 those existing in the case of a deformed rickety child in the same attitude. The circles in the pelvis in Figs. 16 and 18 indicate the position of the acetabular cavities.

If when the heels are in apposition, and the inner margins of the feet be made to include a right angle, the hips and knee-joints be flexed through an angle of 10° or 20° , the plumb-line, dropped from the head of the femur, falls through, and then considerably inside the centre of the knee-joint, the interval between the plumb-line and the centre of this joint being great, although the amount of flexion is slight. This attitude of flexion is of necessity assumed by the rickety child when in the erect posture, and it is obvious that, while in this attitude, the internal condyle transmits much more of the superjacent pressure than does the outer, that there exists a tendency for the patella to be displaced inwards upon the inner condyle, or even on to its inner aspect, and to the yielding of the abnormally soft long bones in an oblique plane whose direction is outwards and forwards, the amount of outward deviation depending partly upon the degree of flexion of the joints, and partly upon the size of the angle included between the inner margins of the feet. In this manner bow-leg is produced.

Fig. 20 represents the appearance presented from the front of a normal leg, of which the joints are slightly flexed, the margin of the foot including an angle of 90° with its fellow.

Fig. 21 represents a similar view of the leg of a rickety subject, which presents the changes which produce bow-legs.

If, however, the rickety infant retains its flexed limbs in such

Fig. 18.

Fig. 19.—Diagram of infant affected with dorsal excurvation.—A B C indicates dorso-lumbar flexion.—B C D indicates flexion of lumbar spine upon pelvis.—D C indicates pelvis.—C D E indicates the limit of extension of the femur D E upon the pelvis D C. This angle is equal to that in Fig. 10.

Fig. 20.

a position that the inner margins of the feet are parallel to one another, the plumb-line dropped from the head of the femur re-

Fig. 21.

tains the same relative position to the centre of the knee-joint as it does when the legs are straight. This is the nearest approach to the easy erect attitude which such a deformed infant can assume. Here, however, the mechanical conditions differ from those which exist in the easy erect posture in the normal individual, since there does not exist any tendency to the formation of a gradually diminishing anterior femoro-tibial angle, but, on the contrary, the rickety bones obey, in a varying degree, the tendency to yield in an oblique plane, whose direction is inwards and forwards, producing the condition called rickety knock-knee, which is very distinct in its causation and pathology from simple knock-knee.

Fig. 22 represents the left leg of a case of rickety knock-knee,

Fig. 22.

looked at from its outer aspect. It shows remarkably well the considerable curvature of the long bones in an antero-posterior plane.

Owing to the length of this paper, I have omitted to prove that a very large proportion of the cases of lateral curvature of the spinal column are also the result of the habitual assumption of attitudes of rest, either simple or complicated by an attitude of activity. I trust, however, that I have sketched sufficiently clearly matters of vital importance in the study of the causation and pathology, and consequently of the treatment, of conditions which have up to the present been regarded as very complex, for the reason that these several deformities have been considered separately by different observers, and have not been regarded as the simple mechanical results of pressure influenced in the rickety subject by the altered and impaired nutrition of the osseous system.

ANAL FISSURE.—Dr. Gregney (*Gaillard's Medical Journal*) recommends a simple, painless, but effectual method of treatment of anal fissure. It consists in first securing a thorough evacuation of the bowels every morning, and then introducing between the lips of the fissure a few shreds of lint saturated with a solution of chloral (1 to 50). This lint is left *in situ*. These dressings are repeated daily; the fissure is said to disappear about the tenth day of treatment.

THE CÆSAREAN SECTION: WITH NOTES OF A SUCCESSFUL CASE.¹

By MURDOCH CAMERON, M.D., F.F.P.S.G.,

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C. C. aged 27, primipara, was admitted into the Glasgow Maternity Hospital on April 10th, 1888, at the time of the forenoon visit. She was a little woman, somewhat delicate, and with all the appearance of a patient deformed by rickets in a very marked degree. She stated that she was in labour, at the full term of pregnancy, and had lately enjoyed good health, and that she felt foetal movements.

The following measurements were taken:—Height, 49 inches; anterior superior spines, $8\frac{3}{4}$ inches; iliac crests, $8\frac{1}{2}$ inches; external conjugate, $5\frac{1}{2}$ inches; internal conjugate, $1\frac{1}{2}$ inch.

On examination the promontory of the sacrum was easily reached with the finger, and the conjugate diameter only permitted the insertion of two fingers. In such cases of deformity there is usually a little more space to either side than in the conjugate, and here it was upon the right side, but not sufficient to be of any practical value. The legs were very much deformed from rickets, and she had not been able to walk till several years of age. On examination of the chest nothing abnormal was detected in the heart or lungs.

A consultation was called, and Drs. S. Sloan, Reid, Oliphant, and Black attended. After individual examination they all came to the conclusion that the conjugate of the brim was not more than one inch and a half. Dr. S. Sloan advised section as being the only practicable procedure; Dr. Reid discussed the question of craniotomy, but recommended section; Drs. Black and Oliphant concurred in these opinions.

The patient and her father having consented to any operation that might be thought advisable, she was put under chloroform at 4.30 P.M., ether being afterwards used. She bore the anæsthetic well and without sickness. The pubes having been shaved and the abdomen washed, an incision was made in the middle line from the umbilicus nearly to the pubes. The parietes were thin, and the few vessels cut were easily controlled. The incision into the uterus extended from below the fundus on the anterior aspect straight down for about five inches. The membranes were hooked up and an opening made, after which the living child was immediately extracted by the presenting head. He weighed 6 lbs. 12 oz. The placenta was detached and removed in a few minutes, the membranes being complete. There was free hæmorrhage from the sinuses. A finger passed from the vagina through the os uteri met another finger passed through the uterine incision, showing that there was a free channel for the lochia.

Seven silk antiseptic stitches were passed through the outer two-thirds of the uterine wall, and friction was applied to the fundus to ensure thorough contraction. The stitches on being tightened immediately checked the bleeding. Fifteen minims of Tanner's solution of ergotine were injected into the thigh. The abdominal cavity having been carefully sponged out, and the external wound closed with nine antiseptic silk stitches, three long strips of adhesive plaster were applied at intervals, and the parts dressed with boracic cotton and sublimated "Gamgee," over which the binder was applied.

Everything about the patient was immediately changed; hot pans were placed round her, and nurses appointed to take charge of the case. The time occupied was about fifty minutes. At night after the operation the patient felt well, and slept at intervals. She got iced milk and soda in teaspoonful doses amounting to an ounce every hour.

April 11th. The report stated that she had slept a little during the night after a half-grain morphine suppository had been given. She did not sleep during the day but felt well. The quantity of milk was increased to an ounce and a-half every hour. She complained only of thirst and hunger, and wanted food. She voided urine, but the catheter was passed every six or eight hours.

April 12th. She had slept nearly all night. On examination the abdomen was found distended with flatus. Complained of the milk and soda making her sick. Got a small mixture of pepper-

¹ Read in the Section of Obstetrics at the Annual Meeting of the British Medical Association, held in Glasgow, August, 1888. The mother and child were presented to the meeting.