vention of CO_2 loss from an excessive respiration due to peripheral irritation as pointed out in the previous section. It is also of direct benefit in the production of a relaxed anesthesia under nitrous oxide, because a large amount of this gas as well as oxygen must be absorbed for this purpose. As Haldane and others have pointed out, a slight increase in the CO_2 percentage of the inspired air doubles the volume of the air or mixture inhaled by stimulation of the respiratory center, consequently his increased depth and rate of respiration renders more nitrous oxide and oxygen available to the blood. (This must not be confused with an increased depth and rate of respiration which is a reflex result of peripheral irritation and which causes an undesirable reduction of the CO_2 content, unless provision is made to offset the same by rebreathing.)

In addition, the apparatus is equipped with an electric motor and air pump for use when air is desired as a carrier for ether in such cases as are found unsuitable for gas-oxygen anesthesia. Whether or not, for intratracheal work, the gas-oxygen ether or the air-ether mixture will be found most suitable is yet to be determined. For the use of the intratracheal method there is a separate connection from that to the mask, in the circuit of which is placed a mercury safety-valve to prevent the danger of undue intrathoracic pressure, a danger which without question must be efficiently overcome.

At first glance this apparatus may look complicated and difficult to use, and, therefore, like its predecessors, appear impracticable. Such is, however, not the case, as these seeming complications remove from the anesthetizer all operative difficulties; in fact, they need no attention, thus leaving him free to give his whole thought to the patient. After becoming acquainted with the nitrous oxide-oxygen ratio of the patient the hand valves need not be touched for intervals of five or, sometimes, ten minutes. The details of operative technic I will reserve for a future paper.

IV. CONCLUSIONS.

(1) The first attempt to give a public demonstration that the body could be safely rendered insensible to pain for surgical procedures was made in Boston by Dr. Horace Wells, a dentist of Hartford, Conn., with nitrous oxide in December, 1844, or January, 1845, nearly two years before the demonstration of ether by Morton at the Massachusetts General Hospital, on Oct. 16, 1846.

(2) Nitrous oxide-oxygen anesthesia, with the addition of such minimal quantities of ether vapor as may be needed, is the anesthetic of choice.

(3) The general use of this anesthetic is dependent on the perfection of an apparatus which overcomes the mechanical and operative difficulties attending its administration.

(4) Such an apparatus is described.

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RELATION OF THIGH AND LEG MUSCLES TO MALPOSTURES OF THE FEET.

BY C. L. LOWMAN, M.D., LOS ANGELES, CAL.

THE consideration of this subject, in this way, was suggested by my studies of the past three years on postural strains and muscle imbalance which a number of men have been pointing out, my observation being also stimulated by an especial interest in growth, structural changes and diseases of feet and legs, and I am offering this as a preliminary report.

I. The malpositions of the feet vary in nature and degree according to faulty weight bearing, unopposed muscle action, or imbalance, due either to weakness, mechanical position or paralysis, and varying club foot positions, which are usually congenital or paralytic.

The commonest are the varus and valgus positions, and it is in regard to the latter that I wish to call your attention.

The common condition of valgus at the ankle spoken of as "pronation," "knock-ankle," "in-ankle," etc., is caused most frequently by bad statics or paralysis, and I shall discuss only the former.

II. The line of weight bearing in the leg, which I shall speak of as the "weight line," is a perpendicular dropped from the anterior superior spine of the ilium, which, passing through the center of the patella, falls within the foot just to the outside of the head of the first metatarsal in the male, and, in the female, allowing for the

inward inclination of the femur, it will not be quite so far out.

III. I began by studying the effect of arch supports on the foot position, especially these pronated cases, noting especially that the common store plate, after being worn but a short time, would roll and tilt in, so that the outer edge, where the weight should be borne, was not touching the floor at all. Plates modeled over a plaster cast with only a moderate correction would often be unbearable, and the patient would return with a sore, sensitive place under the scaphoid, showing also an inward bulging of the shoe and often with the marks of the inner edge of the plate on the shoe.

Many would get moderate relief of symptoms for a time, but their valgus position was not bettered.

Next I looked into the treatment by exercises of foot and leg muscles, such as "rising on toes, coming down on outer border of foot," "adduction of foot," "flexion of toes," "outward circles," etc., and found after persistent and careful work muscles would be in good tone, pain would be less, cramps in feet were better, etc., but the pronation still persisted, although in some cases considerably modified.

Next I looked into the question of pain, cramps, tired feelings, etc., through back, hips and thighs, of which so many of the cases complained, frequently relieved as regards pain, and tired feeling modified somewhat, but in a great many cases not satisfactorily.

In those cases complaining of "rheumatism in feet and knees," "growing pains 'at knee,'" "cramps in thighs and legs," "a sore place over the lower part of the back," and others just a "continued tiredness," especially much worse on standing still than walking, with or without aching in feet, knees or hips, I found nearly all showed a condition of inward rotation of the leg in relation to the weight line and the knee cap pointing toward the opposite side, making the projected line from the anterior-superior spine through the knee fall on the floor to the inside of the foot.

This was more exaggerated in those cases that walked in a "weakfooted" or "out-toe position."

The following suggestive points would be noted in their histories: "Mother says child used to fall very often"; "couldn't run as well as other children"; "always had weak ankles." Among older boys and men in college was noted "difficulty in running"; they had "trouble with the stride"; "could only run so fast and then wobbled," or "threw one or both feet too far to the side."

A number examined had ridden horseback a great deal and had one or both knees decidedly inside the weight line, often with pain around inner aspect of knee.

Another most interesting observation was this: In a great number of small boys, ranging from six or seven to fourteen or fifteen, in the gymnasium, fully 75% of them, both fat and thin, who had faulty posture or knock-knees with

pronated feet, needed circumcision or had only recently been attended to. In all of them marked inward rotation of the thigh with bad foot position was usually found.

A test which shows this is the following: Patient is told to stand in natural position and, closing the eyes, to put the feet in a moderate "pigeon-toed" position, and they usually swing the toes around to about parallel or less, or, putting it in another way, patient's feet are placed parallel and when asked what they felt said, "I feel pigeon-toed," or "it draws and pulls here," pointing to inner aspect of thigh.

IV. I found that in nearly all these cases I could, by twisting the thigh outward, bring the knee toward or into the weight line, and when this was done, the valgus at the ankle partly or wholly disappeared.

This class of cases usually being flexible, with the big toe held down firmly, the arch would raise and a good position would result.

Considering the leg from the hip down to be a lever, varying from two to three feet long, with a tight mortised grip on the astragalus, rotate the thigh inward and outward and the astragalus of necessity responds by a similar rotation.

If, then, when the foot is in valgus with its adductor group stretched out, tired and letting down, then the knee and thigh, which are rotated in, will have their external rotators similarly stretched, thus accounting, to my mind, for a great many symptoms, such as pain, cramps, tired feelings, drawing and pulling sensations in thigh and back, the relief of which we have all seen to follow certain treatment of feet with Thomas heels, plates, etc.

The usual routine, however, in foot examining, I have noticed, has nearly always been to consider the foot position in relation to the knee, rather than in relation to the hip or anterior spine.

Consequently, the ordinary exercises given to muscles below the knee, the plates, shoes, etc., do not control, sufficiently, the faulty position of knee and thigh. Let me cite a fair example of such a case:

Miss X., age sixteen, weight 118, tall; nervous makeup; rather under nourished; studying hard in school; growing rapidly. Comes complaining of tired feet, legs and back; cramps in thighs and calves and pain over inner side of foot and ankle, very severe at times, especially more on standing, as when "waiting for a car," or "standing at the blackboard." Has tried various kinds of shoes and arch supports, which helped for a week or two and then seemed to make her worse, causing a callosity on inner side of foot.

Family history. — Negative.

Past history. — Always well as a child, but rather delicate. Could not run and play as vigorously as other children. Frequently turned ankles. Has had more trouble for the past four years with feet and legs; very much worse since entering high school.

Examination. — Standing posture fair, but relaxed. Shoulders forward a little. Sitting posture poor. Leg length equal. Weight line falls $3\frac{1}{2}$ inches inside of big toe. Inner condyles of knee somewhat large. All leg movements free.

Feet: When bearing weight show marked valgus, with anterior foot abducted and considerable letting down of posterior arch. Feet long and flexible; congested; cold and moist. With weight off arch, about one half restored, but foot hangs in abduction. Peroneals tense and strongly developed. Arch support she has worn lists inward and is unstable. When thigh is rotated outward and big toe held gently on floor, astragalus rides upwards and outwards, restoring shape to foot, valgus disappearing.

Treatment.—Case treated with straps and pads for six or seven weeks, with exercises for feet and legs to strengthen and tone up adductors of leg and external rotators of thighs and back extensors. Arch supports to prevent foot from actually dropping into flat-foot position. Corrected shoes and care in walking straight footed; also attention to sitting and standing posture. Tonics internally. Cold baths in morning. Hot and cold douching of feet and legs. Attention to general hygiene.

Patient reported every month greatly improving, pain and symptoms gradually disappearing. When asked to take off shoes and stand up, feet are seen to be in better position; much less valgus; weight carried farther to outside; inside held up more easily. Mother,

reports child is walking straight footed and holding ankles in better position without thinking about it. Shoes show much less bulging or wear on the inside.

Such improvement goes on so that at the end of a year to a year and a half the case is greatly benefited, if not entirely cured. However, in girls we must not overlook the fact that, due to inward position of femur, the knees will always tend to drop in, so patient is made to understand that proper shoeing is essential and an occasional stiff course of exercises may be necessary to prevent relapse.

A large percentage of foot cases fall in a class with the one just cited, and I have found the following simple apparatus of great help in making the thigh exercise more efficient.

On a wooden foot board, eighteen inches or more square, according to patient, place a block (D) 1 1/2 inches square in such a position that it comes between the heels when the patient stands in the middle of the board with feet parallel and about 1 1/2 inches apart. Place a rod (B) running from the block forward a little past the big toe

and two others (A and A) parallel to the outer border of feet and close enough to the surface of the board (say 1/4 inch) that straps (C and C) fastened under them and over the anterior foot will hold the feet firmly.

Patient places hands on hips (unless necessary to steady himself by holding to something), grips the block with his heels, draws glutei muscles together firmly, extends the back, rotating the knees and thighs outward, holding position for a definite number of counts, gradually increased. When hallux valgus is also present, pass a smaller loop around big toe and draw it toward inner rod.

Another good exercise is this:

Pass a loop over anterior foot, to which fasten a cord; this cord passes inward over a pulley

which carries a weight at the end. With the leg extended and the heel fixed, rotate the thigh outward against resistance of weight.

Same can be accomplished by using an elastic webbing strap similarly adjusted.

I am still at work on the idea, which may be modified as seems necessary, and am also working on a brace which I hope will help in early and marked cases of pronation.

The conclusions from this study (i. e., that positions of the knee and thigh in relation to the weight line and as affected by the action of the external rotators of the thigh have a marked effect on that malposture of the foot known as "pronation" or valgus) have been drawn from careful observation of about 300 individuals of all ages, about 50% under eighteen years of age,

and in whom, when under treatment, best response was gained.

This is offered merely in the hope that others with attention directed along this line may accomplish more in helping the child afflicted to grow straight, and to aid more effectually those who are suffering pain and discomfort by reason of bad statics.

HEMORRHAGE FROM THE THROAT.*

BY ALBERT C. GETCHELL, M.D., WORCESTER, MASS.

NINETEEN years ago, a gentleman of middle age consulted me for his throat. His general health, he said, was and had been excellent. He was honest in this statement, for he had lived the life of an active business man, with no interruptions for sickness, and had retired not for ill health, but because he had accumulated wealth and wished to do so. He was under my care for about three years.

Dec. 11, 1895, he reported that the previous night he had had a slight hemorrhage. At this time he also stated that twice before within the last twelve years he had spit blood and afterwards his throat felt better. I thought of pulmonary tuberculosis and suggested an examination of his lungs. But he was so positive that there could be no trouble there, that I did not press the point. I remember he said he was sure the blood came from his throat, because he felt that it did. Blood could be seen in the larynx on the first visit after the blood spitting, but being washed away showed no bleeding point. There was a vein at the base of the tongue that looked as if it might have ruptured, and I treated this area for a time till all symptoms abated and he passed from my observation.

In April, 1897, two years later, I made this note: "Last summer he consulted Dr. F. I. Knight, who found old pulmonary disease and advised him to go to Colorado. He did so and died soon after of typhoid fever. An autopsy showed extensive pulmonary disease."

This case made a deep impression on me and I have never since allowed myself to agree to or be responsible for an opinion that spitting of blood was due to any other cause than pulmonary tuberculosis, until by examination of the throat I had found a lesion there to account for it, or until by careful study of the history and general condition of the patient, together with exhaustive physical examination of the lungs, and also examination of the sputum, no evidence of pulmonary tuberculosis could be found, or until disease of some other organ, as, for instance, the heart, capable of producing the accident was found. And if nothing could be found, I have assumed the cause to be tubercular disease of the lungs. For an early hemorrhage may be due to a lesion which it is difficult, if not impossible, to find. It may occur in a person apparently in perfect health; the sputum may show no tubercle bacilli, there may be no rise of temperature or acceleration of pulse, and no physical signs in the chest which the most skillful can detect. It is a well-recognized fact that when there is tubercular

trouble in the lungs advanced enough to make itself evident by physical signs, the disease is pretty well started.

I do not say that a hemorrhage may not have its source in the throat. There is evidence enough of this to establish the fact. Bosworth, with his usual thoroughness, in the chapter on the subject in the two-volume edition of his work, cites several cases and gives references to others. Other textbooks on the throat take the same ground. I have never seen such a case. On the other hand, I have seen many cases of pulmonary tuberculosis that gave antecedent history of blood-spitting in which the medical adviser had said it came from the throat and was of no importance. Dr. John B. Hawes, 2d, has recently studied the histories of the patients in the state sanatoria and has kindly given me these figures on hemorrhage.

"Out of 500 patients now at the four state sanatoria, there were 81 who consulted their physicians on account of hemorrhage. Out of this 81, 42 were told by their physicians that they had consumption, the remainder (39) were told that they did not have consumption, but that the blood either came from elsewhere or did not mean anything serious."

Bosworth says: "In former days all cases of hemoptysis were generally considered as indicative of pulmonary disease. The introduction of the laryngoscope, however, enabled observers to recognize the laryngeal mucous membrane as a not infrequent source of hemorrhage."

My experience would lead me to reverse this dictum to the effect that since increasing care had been paid to the diagnosis of pulmonary tuberculosis, hemoptysis is often found due to this disease and not to a supposed lesion in the throat.

The reason for the failure to attach to blood-spitting its due significance is twofold. First, many physicians think that unless they can by physical examination detect evidence of pulmonary disease or can find tubercle bacilli in the sputum the disease does not exist, and, secondly, a disinclination to tell a patient he has the disease except on the most conclusive evidence.

I have already alluded to the fact that the most expert skill may fail in finding definite physical signs, even though the disease is present and active. Furthermore, the existence of pulmonary tuberculosis does not necessarily imply serious consequences. A familiar postulate of modern pathology is that many have had pulmonary tuberculosis who have got well and remained well without ever knowing they had the disease. And so a slight lesion in one of good resistance is not or may not be a serious matter. He may get well with slight modification of his daily life and a longer or better arranged vacation than he has been accustomed to allow himself. On the other hand, if a hemorrhage is a signal of more marked activity, the sooner a patient gives up all work and devotes himself to cure the better.

The duty of the medical adviser is clear: either to put the facts plainly before the patient, or, if he can keep him under observation for a

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