great traveller, tells us it was the most interesting of all the theatres existing in his time, and to-day anyone who is familiar with the theatres of Greece and the Greek colonies will say that this is more impressive than any of them. The Koilon or auditorium consisted of fifty-five rows of marble seats with twenty-four lines of stairs. The space for the chorus is, according to the ancient system, circular, and in the centre doubtless stood an altar of Bacchus. The stage was elevated nearly 12 feet, the proscenium being enriched by splendid sculpture. The acoustics of the theatre are perfect; a sound little louder than a whisper uttered on the stage can be heard in every part. The theatre is so placed on the slope of Kynortion that the occupants of the major part of the auditorium had a charming view (over the top of the stage) of the mountains to the north and of the whole range of beautiful buildings of the Hieron. While witnessing here the sublime tragedies of Æschylus or Sophocles, or such a comedy as *The Plutus* of Aristophanes (in which, as you will remember, great fun is made of Asklepios and his priests), the contrast afforded by glancing from the stage to the blues and purples of the mountains, the verdancy of the grove, and the beautiful forms and colours of the group of temples would be most pleasing. The Greeks were acute in perceiving and taking advances of subtle sources of pleasure like this, and I believe that the sites of many of their theatres were chosen so as to secure for the audience this double pleasure. The Theatre of Delphi is an example of this provision, as also in a less degree is that of Tauromena. This theatre has been said to seat 12,000 spectators; according to my own rough computation, it unquestionably will hold over 9,000 without crowding.

No. 16 represents certain Roman buildings external to the precincts, the object of which is undetermined.

No. 17 is probably the northern boundary of the precinct.

No. 18 represents a part of the southern boundary, the rest of the boundary line has not yet been ascertained.

No. 19. The Stadium. It is not certain yet which is the semicircular end; formerly it was supposed to be that adjoining the sanctuary, now it appears more likely to have been at the other extremity. As yet only a portion of it is excavated. It was over 600 feet long, and on either side were fifteen rows of marble seats; probably foot, horse, and chariot races took place here as well as other forms of athletic exercise.

Before saying anything about the ritual and the treatment of the sick at the Hieron, it will be well to turn to the Asklepeion at Athens, and examine briefly the structural arrangements there. Situated on the south side of the Acropolis, at an elevation of perhaps 80 feet above the plain, adjoining on the east the theatre of Dionysius, the locality was probably as healthy as any the immediate neighbourhood of Athens could supply. The buildings were to a certain extent an imitation, on a smaller scale, and on a limited area, of those at the Hieron of Epidauros. Remains of what were probably a temple of Asklepios and Hygieia, of Doric architecture, also a supposed temple of Themis, and a shrine of Isis, exist, while smaller shrines of Serapis, Core, Hypnos, Herakles, Panacea, Demeter, and other divinities have left no distinct traces. There are considerable remains of a large Eastern portico or abaton of Pentellic marble, from which is reached a circular chamber in the rock containing the sacred well. Close to the abaton is a curious well-like structure, surrounded by marble columns, which perhaps was the serpent pit. A western portico or abaton also existed, and a grove containing great numbers of statues, busts, ex-votos, and inscriptions. The annexed outline sketch (p. 1512) may help in giving some general idea of the precinct. The theatre of Dionysius close at hand was doubtless frequented by the sick as a diversion. The stall occupied by the priest, with his name on, it is still in excellent preservation. The Panathenaic stadium, about half a mile away, doubtless was also frequently visited by the convalescents from the Asklepeion.

By the will of the late Dr. Elizabeth H. Bates, of Port Chester, N. Y., the University of Michigan will receive 125,000 dollars, the income from which is to be used in establishing a chair for the diseases of women and children, to be known as the Bates Professorship.

COMPLETE ATROPHY OF THE DELTOID WITH VICARIOUS RESTORATION OF FUNCTION.*

[WITH SPECIAL PLATE.]

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M. K., aged 22, presented himself at the dispensary of the Western Infirmary, Glasgow, on June 21st, 1897, complaining that after a hard day's work he experienced stiffness in his back and right shoulder.

On January 29th, 1895, he fell into the hold of a ship, and, on being admitted to the Western Infirmary, it was found that he had sustained a subcoracoid dislocation of the right shoulder-joint, together with a fracture of the radius of the right forearm. The dislocation was reduced on the day of his admission, and the forearm put in splints.

After removal of the splints he was unable to use his arm for about six months, and, although practising daily with dumb-bells, was unable to elevate his arm at the shoulder-joint to any appreciable degree for eleven months, at the end of which time he returned to his work. The improvement then steadily advanced, and now his range of movement and power at the shoulder-joint is such that only careful inspection detects any abnormality.

At present, and as shown in the accompanying illustration, his physique is good, the muscular system being well developed. With the arms hanging by the sides, it is easily seen that the right deltoid is greatly atrophied, the roundness of the shoulder having disappeared, and the acromion and coracoid processes and head of the humerus rendered prominent. Seen from behind, the outer half of the spine of the scapula is prominent from absence of the deltoid, and from the front there is a hollow below the outer half of the clavicle from absence of muscular tissue.

Despite this condition of the deltoid, the degree to which the right arm can be elevated is not much less than in the case of the left arm, and the movement is performed with apparently as much ease on the one side as on the other. In this position of the arm, however, the area of the deltoid shows no prominence corresponding to the contracted deltoid of the opposite side, but there is a well-marked prominence corresponding to the portion of the trapezius inserted into the angle between the clavicle and the spine of the scapula, a prominence which is entirely absent from the left side. Another point of difference between the two sides is the degree of rotation of the scapula when the arm is elevated, which is so marked on the right side that the inferior angle is carried in front of the lateral line. This rotation of the scapula is marked, when the patient is viewed from the front, by the axilla looking more in a forward direction than that of the opposite side.

His range of movement in the affected arm leaves little to be desired. He can place the right hand on the crown of his head and on the nape of his neck with as much ease as he can his left, and has quite as much power in performing these movements on the right as on the left side; indeed, using his right arm at his work more than the left, he performs these movements at the right shoulder-joint with greater precision and ease than in the case of the left. There are, however, some movements which he performs defectively. Thus he has difficulty in throwing a stone, and when he puts his hand in his trouser pocket he cannot withdraw it so easily as in the case of the other arm. The total absence of contractility in the right deltoid is demonstrated when the hand is placed over the muscle, and the patient directed to elevate the arm; for, while all the neighbouring muscles become tense and prominent, the region of the deltoid is found in precisely the same condition as it is when the arm is hanging by the side. The various bony prominences are felt as if covered only by skin and subcutaneous tissue. There is absolutely no response to electrical stimuli. There is also distinct atrophy of the muscular mass at the axillary border of the scapula, due doubtless to atrophy of the teres minor. On the other hand, on placing the hands over the cervical portions of the trapezii, and directing the patient to raise

* The paper was read and the patient shown at a meeting of the Glasgow Medico-Chirurgical Society.

his arms, there occurs on the right side a striking tension and bulging, evidently from hypertrophied muscular tissue. Also when the arm is elevated the region of the supraspinatus is more prominent and tense than that of the left side, and the lower fasciculi of the serratus magnus can easily be felt to be more bulky than those of the opposite side.

The marked degree to which the scapula of the right side, as compared with that of the left, is rotated during the movement of elevation of the arm, is manifest from the following measurements taken with compasses. With the arms hanging by the sides, the distance from the dorsal median line to the inferior angle of the scapula is on either side $3\frac{1}{2}$ inches, while in maximum elevation the distance increases on the left side to 6 inches, and on the right to 8 inches. In the latter position the inferior angle of the right scapula is in front of the lateral line, the posterior surface directed more in an outward direction than that of the left side, and the right axilla looks almost directly forwards.

The upper part of the vertebral border of the scapula in elevation of the arm approaches the median line to a greater extent than on the opposite side, and the distance from the tip of the acromion to the spines of the vertebrae, which with the arms hanging by the sides is on either side 8 inches, becomes in elevation of the arm on the left side 6 inches, and on the right $5\frac{1}{2}$ inches. The acromial end of the clavicle also is considerably elevated and drawn backwards when the arm is raised.

The comparative levels of the roots of the spines and of the inferior angles of the two scapulae alter during the movement of elevation of the arms, for in extreme elevation the former point on the right side sinks 1 inch below that of the left side, and the latter point rises on the right side 1 inch above that of the left side, a result only possible by extreme rotation of the right scapula.

In addition to the above measurements, taken with the object of showing increased rotation of the scapula as a factor in the elevation of the arm, several angular measurements were taken to determine the extent to which elevation is effected by movement at the shoulder joint. Thus a straight line drawn from the inferior angle to the tip of the acromion meets the axis of the limb at an angle of 50° , and that on both sides. When the arms are elevated to the maximum, the same two lines form on the left side an angle of 140° , and on the right that of 80° . Taking the difference of angles between the two positions of the arm, it is evident that on the left side movement of the humerus on the scapula takes place through an angle of 90° , while on the right side the range is limited to 30° . These results are verified by comparing the angles formed in the two positions of the arms by the junction of a line corresponding to the spine of the scapula with the axis of the arm. Thus, with the arms depressed, the angle on either side between these two lines is 90° , while in maximum elevation, on the left side the angle is 180° , and on the right 120° , a difference again of 90° and 30° respectively.

REMARKS.

Vicarious muscular supply was first brought prominently forward by Létievant¹ in 1873. The case first published by him in 1869² was one of traumatic tetanus arising from a wound in the hand, for the treatment of which, in accordance with the pathology of the time, the median nerve was divided in the upper third of the arm. As a result of this the muscles supplied by that nerve were paralysed, and at the end of nine months, although reunion of the nerve had not occurred, and although as a result atrophy of the muscles supplied by it had taken place, yet movements resembling those performed by the paralysed muscles were possible, and in some cases strongly developed. This result Létievant showed to be due to muscles in the neighbourhood, whose supply remained intact, taking the place of the paralysed muscles, although necessarily imperfectly. On this case he founded his theory of "suppléances motrices et sensitives."

The case the history of which I have given above illustrates the possibility of a very complete substitution by neighbouring muscles for the function of an atrophied deltoid. The explanation of the atrophy of the deltoid in this case is clear from the history. The circumflex nerve was either torn at the time of the dislocation and did not reunite, or if not torn it was ultimately subjected to pressure by

cicatrization resulting in damaged tissue in its vicinity. In any case the total atrophy of the deltoid with atrophy in the region of the teres minor indicates the destruction of the circumflex nerve. The previous history of the case shows that from the time of the accident until after the lapse of many months the arm was practically useless, and that improvement only occurred very gradually, and that when the arm had sufficiently recovered its function to enable the patient to return to his work, the regular exercise thereby secured was followed by a steady recovery of function. It thus required a period of at least eighteen months for the neighbouring muscles destined to supply the function of the atrophied deltoid to adapt themselves to the new conditions. It is impossible to say what time must elapse before the adaptation reaches its limit, for the complaint which brought the patient to me, namely, pain in the back and shoulder after a hard day's work, shows that the muscles supplying the function of the deltoid are still, two years and a half after the accident, overtaxed by the work they have to perform.

The arm is now raised by :

1. The supraspinatus.
2. Muscles rotating the scapula.
3. Torsion and curvature of the vertebral column.

The degree to which the supraspinatus elevates the arm is shown by the angular measurement between the scapula and the axis of the limb to be 30° . On the left side the combined action of the deltoid and supraspinatus results in a range of 90° . It is not likely that the normal elevating power of the supraspinatus is 30° , and if so that muscle is probably in this case hypertrophied, and acting as one of the vicarious factors. The abnormal tension over the supraspinous fossa is accounted for on the supposition of such hypertrophy.

The second vicarious factor in raising the arm, namely, increased rotation of the scapula, accounts for a considerable extent of the restoration of function of the deltoid; for while on the sound side the rotation during complete elevation of the arm causes the inferior angle of the bone to move through a distance of $2\frac{1}{2}$ inches, the same movement causes the right inferior angle to move through a distance of $4\frac{1}{2}$ inches. This rotation is brought about by the combined action on the scapula of the portion of the trapezius inserted into the angle between the acromion and the clavicle, and by the lower portion of the serratus magnus. The portion of the trapezius in question is much hypertrophied, standing out in contraction as a bulky mass. In its action it also raises and draws backwards the clavicle, whose rhomboid ligament has probably become stretched. The hypertrophy of the serratus magnus, although of course not visible like that of the trapezius, still can be felt, and probably several of the lower slips are acting as a powerful factor in rotating the scapula.

The extent to which the arm can be raised by the application of these two factors is shown in the illustration, the patient having been placed with the body straight, but elevation to the almost vertical position can be effected by the aid of torsion of the body to the right, and lateral curvature to the left. When the patient was directed to raise his arms to the utmost, he at once assumed this attitude of body. Thus the supraspinatus alone raises the arm to 30° as compared with 90° effected by the combined action of a normal deltoid and supraspinatus, and the difference of 60° is attained in the first instance and chiefly by the rotation of the scapula, and finally, when rotation has done its maximum, the elevation is completed by torsion and curvature of the trunk.

The case illustrates the extent to which, at least in some cases, recovery of function may be expected in cases of atrophy of the deltoid, resulting from injury to the circumflex nerve, without any operative interference. The recovery in this case is so nearly perfect that it is questionable if a better result could have been attained had the nerve been exposed and treated with a successful result. Taking into account even the length of time necessary for the establishment of supplementary function, it is still questionable if, by operative interference for the repair of the circumflex nerve, any time would have been saved in the restoration of the power to elevate the arm, as in any case atrophy of the deltoid would have been far advanced before the nature of the case could have been sufficiently established to warrant an operation of the kind. Then, with atrophy so far advanced,

recovery of the muscle would have been a matter of at least many months.

I publish the case partly for its general interest, as showing vicarious muscular supply after nerve injuries, and partly for its special interest, as showing what may be expected in favourable cases in the way of recovery of function in cases of atrophy of the deltoid.

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¹ Létévant, *Traité des Sections Nerveuses*, Paris, 1873. ² *Ibid.* Phénomènes physiologiques et pathologiques consécutifs à la Section des Nerfs principaux du Bras, *Lyon Méd.*, No. 21-22, 1869. Virchow-Hirsch, *Jahresbericht*, 1869, Bd. 2, pp. 291, u. 321.

CASE OF ACUTE RACHITIC CURVATURE OF TIBIÆ BACKWARDS.

[WITH SPECIAL PLATE.]

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As regards the rachitic changes in the lower limbs, although the enlargements of the upper end of the tibia and the lower end of the femur occur next in order of frequency to the lower end of the former bone, we do not find the upper end of the tibia nearly so often bent as its lower extremity. While it is very rare to meet with such a condition as the present one of acute yielding of the bone directly backwards below the line of junction of its upper epiphysis, we sometimes find the upper end of the shaft projecting somewhat backwards and outwards at a point just below the tuberosities. Indeed among the numerous casts of rachitic deformities in the museum of the City Orthopædic Hospital there is no example which at all approaches it in severity.

The girl (E. G.), who was aged 17 years on admission, but looked no more than 12, had had somewhat severe rickets during infancy. Her father and mother were quite healthy, and her three brothers, residing in the United States of America, older than herself, had no affection of any kind. She did not attempt to walk until 2 years of age, and at the age of 3 it was noticed that her legs began to be crooked, and she was treated for rickets in a New York hospital. An apparatus was fitted to the spine, but no splints were applied to the legs, as she was told the condition of these would get better of itself in time. After her arrival in England her mother took her at the age of 8 to the Evelina Hospital for the bending inwards of the knees, but no splints were applied during the twelve months she attended there. The patient then came to this hospital under the care of my late colleague, Mr. E. J. Chance, who applied first of all straight wooden splints to the lower extremities, and then for the last three years steel mechanical appliances.

The patient then came under my charge, and it was clear that although the steel supports had effected much in correcting the valgus condition of the knees, they did not seem to have benefited the unusual curves of the legs which were now presented, and had up to this time been progressive. The bend at the upper end of each tibia was at the lower level of the tubercle, and presented an appearance not unlike dislocation of the knee. The rest of the bone in each limb appeared quite normal, with the exception that the lower end, like the other long bones of the limbs, was still a little bulky. The femora were much curved anteriorly, but the shafts of the bones of the upper limbs were quite normal. I therefore decided to perform osteotomy on the tibiæ at the point of curvature, which was done on the right side on July, 1897. The tibia and fibula were carefully and gradually divided—the former from within outwards, the latter from without inwards—with an Adams's saw, and their diaphyses forcibly bent backwards, bringing them into a straight line with their upper epiphyses. The limb was then placed on a double inclined plane, to maintain the bones in their normal relations, and prevent pressure on the tibial vessels. Firm consolidation took place in the flexed position, and in order to allow the new bone filling the gap in the divided diaphyses to become quite solid, the limb was kept in this position for two months. At the end of this time extension of the knee was commenced, and carried out gradually to its fullest extent, with an excellent result, as presented by the condition of the

patient when shown to the Hunterian Society in December, 1897.¹

The skiagraphs of the two limbs afforded an interesting comparison of the tibiæ before and after correction of the deformity by osteotomy. The epiphysal lines of the femora and tibiæ were seen to be unaltered from their normal direction. The bones of the left leg were subsequently divided in a similar manner, with an almost equal result. After the correction of the tibial curves the valgus position of the knees became more noticeable. To remedy this, as well as the anterior curvature of the femora, it is proposed to perform infracondyloid osteotomy of each femur.

UNILATERAL RETINAL CHANGES IN CEREBRAL HÆMORRHAGE, EMBOLISM, AND THROMBOSIS.*

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It is well known that in a large number of cases of cerebral hæmorrhage, ophthalmoscopic examination reveals albuminuric retinitis in each eye. It is also well known that in cases of cerebral embolism associated with ulcerative endocarditis, hæmorrhages and white patches may sometimes be found in each retina on ophthalmoscopic examination. Occasionally embolism of the central artery of the retina, with its characteristic ophthalmoscopic appearances, may be associated with cerebral embolism; but such an association is exceedingly rare. In patients suffering from arterio-sclerosis minute changes may be found in the retinal vessels—general or localised narrowing of the arteries, white lines along the sides of the arteries, localised narrowing of the veins, localised varicose dilatations, etc., and of course these may be present when cerebral hæmorrhage occurs. Other rarer retinal changes have occasionally been found in cerebral hæmorrhage and softening.

But apart from the changes just mentioned, I have observed two others in certain severe cases of cerebral hæmorrhage, embolism, and thrombosis, namely, retinal hæmorrhages or dilatation of the retinal vessels in the eye of the same side as the brain lesion, whilst the opposite retina has not presented either of these changes.

The following are brief abstracts of my notes on the ophthalmoscopic examination in 13 severe cases of cerebral hæmorrhage, embolism, or thrombosis. In 12 of the cases the examination was made shortly before death; in one case death did not occur for some time afterwards. The cases were all in-patients at the Manchester Royal Infirmary, and to the kindness of the medical staff I am indebted for permission to record the observations which I have made on patients under their care.

CASE I.—Right-sided hemiplegia. Necropsy: Cerebral hæmorrhage in basal ganglia of left side. Ophthalmoscopic examination during life revealed three large hæmorrhages close to optic disc on the side of brain lesion (left). See Fig. 1. In the opposite retina no hæmorrhages present.

CASE II.—Right-sided hemiplegia. Necropsy: Cerebral hæmorrhage in the basal ganglia of left side. Ophthalmoscopic examination revealed a large hæmorrhage covering a portion of the optic disc on the side of the brain lesion (left). See Fig. 2. The opposite retina presented no changes.

CASE III.—Left-sided hemiplegia. Necropsy: Cerebral hæmorrhage into right basal ganglia. Ophthalmoscopic examination revealed a large retinal hæmorrhage obscuring a portion of the optic disc on the side of the brain lesion (right). See Fig. 3. The opposite retina presented no hæmorrhages.

CASE IV.—Right-sided hemiplegia. Necropsy: Cerebral hæmorrhage into left basal ganglia. Ophthalmoscopic examination revealed several retinal hæmorrhages in the upper half of the retina on the same side as the brain lesion (left). The opposite retina presented no hæmorrhages.

CASE V.—Left-sided hemiplegia of sudden onset; coma; signs of granular kidney; albuminuric retinitis in both eyes; fatal termination no necropsy.

CASE VI.—Right-sided hemiplegia; fundi normal. Post-mortem examination revealed hæmorrhage into the left basal ganglia.

CASE VII.—Right-sided hemiplegia; no retinal hæmorrhage or other changes. Post-mortem examination revealed hæmorrhage into the left basal ganglia.

CASE VIII.—Right-sided hemiplegia; albuminuric retinitis in each eye. Post-mortem examination revealed cerebral hæmorrhage into the left basal ganglia.

¹ BRITISH MEDICAL JOURNAL, December 25th, 1897, p. 1859.

* Communicated at a meeting of the Manchester Medical Society.