

symptoms disappeared. This is not far removed from ordinary observation that it is much better to "get mad" and be done with it than to cherish the grievance in silence. The effort of inhibition seems to call for as much nervous expenditure as that of action, and in such a case as that just cited is of that peculiarly unremitting and wearing character which is so silently destructive of nervous integrity. There should be a proper balance between inflow of irritations and the outflow of motor energy.

Neurasthenia, on the other hand is, by name at least, a much more modern development. The name is hardly twenty years old, and although the condition itself must have been occasionally met with, perhaps for all ages, yet its prevalence is a growth of modern times and a part of the price which we pay for a more complicated civilization. It is certainly much less prevalent among those whose labor is chiefly manual and involves but little responsibility. The histories of one thousand persons show this quite clearly, in the great preponderance of teachers, students, nurses, milliners and dressmakers, over domestic servants or factory hands. In this respect it differs distinctly from hysteria.

I do not recollect hearing of a case among the negroes, nor does my scanty knowledge of the subject furnish instances among the uncivilized races, where again hysteria seems to be well known. It is somewhat difficult to draw the line with certainty, however, between the different occupations which may be claimed as nervously exhausting. I recollect a girl in the City Hospital who said that her doctor had told her that "her brain was all worn out," and when I inquired further as to the nature of this exhausting employment, was informed that it was pasting stamps upon shoes.

(To be continued.)

Original Articles.

ABNORMAL ATTACHMENT OF THE ATLAS TO THE BASE OF THE SKULL.

BY DANIEL DENISON SLADE, M.D., CHESTNUT HILL, MASS.

DURING the past year I received at the Department of Osteology, in the Museum of Comparative Zoölogy, Harvard College, for purposes of identification, portions of a human skeleton which had been lately exhumed at Chicopee, Mass. Among other interesting points presented by the bones, my attention was particularly directed to the cranium, with the base of which the atlas was fused. The comparatively small size of the skull, which was generally well preserved, the delicacy and moderate predominance of its various prominences and processes, as also the dental series, which was normal, these, together with certain characteristics presented by the bones of the limbs, unmistakably pronounced the subject to be that of an aboriginal female, aged twenty-five or thirty years.

The interest excited by the above-mentioned case induced me to investigate the subject of atlanto-occipital fusion, as far as my limited means allowed, and to present the results arrived at in the present paper. Much to my regret, it has been impossible, from the lack of material, to ascertain the frequency of its occurrence among the North American Indians.

The atlas of the human subject may morphologically exhibit several variations from its normal condition. As these variations occupy different regions of the bone, they have been classified in the order of their frequency in any one situation.

(1) The transverse processes of the atlas may present diminution or exaggeration in development. In the former case their normal size may be simply diminished, while in the latter different directions may be taken by the increased growth, producing in some cases a foramen, and in others osseous pillars which may fuse with neighboring parts of the base of the cranium, as, for instance, with the jugular process.

(2) The posterior arch may present deficient or increased development. Under the first condition, the deficiency produces a space in the median line which is the result of an entire absence of co-ossification between the lateral halves. Under the second condition the variation consists of an enlarged and prominent posterior tubercle, or of an increased depth of the laminae.

(3) The anterior arch may in adult specimens exhibit at its median line a suture which usually disappears at an early age. This abnormal condition is probably due to non-union of the lateral masses, which, in the failure of the usual centre of ossification to appear, furnish too feeble a supply of osseous material for their consolidation. Again, the anterior tubercle may become much enlarged and project downwards and backwards in front of the axis, constituting a hypophyseal spine, such as is seen normally existing in the New World monkeys, especially in *Mycetes* and *Lagothrix*.

(4) There may be several abnormal variations simultaneously in different parts of the atlas. Thus there may exist complete fusion of the lateral masses with the occipital condyles, and both arches may present a similar condition in their relation to the borders of the foramen magnum.

The posterior arch may be thus completely fused while the anterior arch is free, or the anterior arch is partially or entirely ankylosed and the posterior free. These abnormalities have been considered as the result of early inflammatory action, followed by more or less absorption, to which process the disappearance of parts is to be attributed.

Dr. William Allen, in his paper entitled "Varieties of Atlas in the Human Subject," cites several cases which illustrate the various conditions that I have mentioned above. Some of these are given by him on the authority of other writers. Two cases, however, had come under his own observation.

In one of them, that of an aged female, whose history is unknown, deficiency occurred in both arches. The posterior arch was entirely deficient, and in the anterior arch there was a symphysis in the middle which admitted of considerable movement. The transverse processes, lateral masses and articulations, were normal. On dissection of the soft parts — after giving a detailed description of bundles of ligamentous fibres which sprang on each side from a slight tubercle behind the lateral mass, and which being traced backwards, interlaced with verticle fibres uniting the posterior margin of the foramen magnum with the arch of the axis — Dr. Allen says: "During the rotation of the head, and the consequent angular motion induced between the lateral halves of the arch, a slight slackening of the transverse ligament of the atlas

takes place, also a slight narrowing of the transverse measurement of the atlantal part of the spinal canal; but displacement backwards of the odontoid process is prevented by an unusually strong suspensory ligament, and the narrowing of the canal compensated for by the absence of the laminae."

A second specimen, of which Dr. Allen gives a drawing in his paper, is described by him as presenting the following peculiarities, namely, a deficiency of the posterior arch, accompanied by an increase of the width of the spinal canal; and the anterior arch, although perfect, is nearly straight, while the transverse processes are depressed and thrown forward to such an extent that their front parts lie in the same line as the anterior arch. By pressing on the sides of the laminae their free ends are approximated so as to close the posterior deficiency and reduce the width of the spinal canal to its normal dimensions. By this means also the proper curve is given to the anterior arch, and the tips of the transverse processes made to assume a more natural direction. The writer thinks that these abnormalities are not due to deficiency of osseous growth but rather to some force exerted at an early period, which, acting like a wedge between the back parts of the atlantal articular surfaces, produced their separation and thus altered the direction of the transverse processes, and also caused the disjunction between the halves of the posterior arch. "The effect is such as might result from the forcing of the wide back parts of the occipital condyles forwards between the anterior narrower parts of the superior articular surfaces of the atlas by strong extension of the head on the vertebral column in parturition in cases of face presentation, and it is highly probable that this is the explanation."

In a case described by Luschka, the lateral masses and upper edge of the anterior arch, as also half of the posterior arch, were joined with the corresponding parts of the occipital bone, while the other half of the posterior arch was absent.

Boxhammer¹ gives a case, in which the lateral masses were completely fused with the occipital condyles; the anterior arch was perfect and free; the posterior arch was open in the middle, one of its halves being free, the other completely fused with the occipital.

Schniffer² describes a case in which the atlas was so intimately fused with the occipital bone as to be with difficulty distinguished. Its lateral masses were so developed and so much displaced as to allow the occipital condyles to articulate with the axis directly. The axis was fused with the third cervical vertebra, the assimilation between their arches being so great as to give one the impression that the common spine belonged rather to the third vertebra than to the second.

A case, similar in some respects to the last, is given by Kussmaul, where the patient, a boy of twelve years, was subject to convulsive attacks of epilepsy, which were induced whenever the head was strongly moved to either side. A post-mortem examination showed that the atlas had a deficiency in its posterior arch and a very movable joint in the centre of the anterior arch. "The imperfect laminae," says Kussmaul, "were caused to overlap whenever the head was

rotated, a constriction of the canal being brought about. This, no doubt, was the cause of the epileptic seizures, by producing pressure and irritation of the membranes of the cord."

Mr. Lawrence, surgeon at St. Bartholomew's Hospital, exhibited an interesting specimen to his class. This showed a bony union between the three first vertebrae and between the atlas and the occiput. The patient from whom it was taken was a boy of twelve years at the time of his death. Five years previously he had suffered from a tumor in the neck, of considerable magnitude, which, being pressed upon, produced a complete state of coma; at other times, the functions of the brain were not impaired. After some time the tumor entirely disappeared and the child apparently recovered a good degree of health. At the end of three years a fresh tumor appeared in the groin, in the situation of a psoas abscess, which was opened, and the patient eventually died from exhaustion. On examination of the specimen the foramen magnum was found natural; but at its anterior left side a thick process of bone, half an inch in length, projected into the cavity of the skull. This proved to be the odontoid process of the axis, which was thinner and more sharply pointed than is normal. On looking downwards through the foramen magnum the rings of the atlas and axis were found to be very irregularly placed, and in such a manner as to contract the foramen magnum to little more than one-third of its normal size. Instead of the posterior arch of the atlas being placed immediately below the foramen magnum, it was contained within the foramen itself. The right half of the ring also encroached considerably within the circumference of the foramen, while the left half had been destroyed by the disease. The axis was also displaced, the left part of the ring still further narrowing the canal, already much diminished by the displacement of the atlas and by the odontoid process which occupied the left side and front part of the foramen magnum. The spinal cord, however, in this confined and tortuous portion of the canal was sufficiently loose to indicate that it had not undergone pressure. The atlas was considerably removed from its relative situation with the base of the skull, being placed obliquely and pushed in front of the condyles, where it was firmly fused with the occiput. The left transverse process had been absorbed, and also the left side of the ring, to the extent of nearly an inch. The axis was removed a little backward; and from the loss of the left part of the ring of the atlas it had ascended so that the upper part of its body was in contact with the edge of the foramen magnum, and its odontoid process had passed through the foramen and projected into the cavity of the skull. This vertebra was of normal size, but was firmly united to the atlas above by bony union, and below to the third vertebra, which last was natural in appearance and position.

The above case illustrates what amount of pressure the brain and cord will endure when it is gradually applied, and how effectually the restoration of the bony parts is due to osseous fusion and to the process of absorption.

In a paper entitled "Abnormal Attachment of the Atlas to the Base of the Skull," published by Professor Macalister, of Cambridge University, reference is given to specimens in the Cambridge Pathological Museum, as also to cases reported by other writers.

¹ Die angeborenen Synostosen an der Enden der beweglichen Wirbelsäule. Zeitschrift für rationelle Medizin, 111 Riecke, Bd. 15, p. 1.

² Virchow's Archiv, vol. lxxiv, p. 320.

This author remarks that congenital fusion of the fetal cartilage of the atlas to that of the occipital region is extremely rare. By pathological processes, however, the whole ring of the atlas may become entirely united to the margin of the foramen magnum. In a Cambridge specimen — which is comparable with the case reported by Schiffner, which I have mentioned — there is perfect fusion of the right side of the anterior arch, of the articular processes, of the true transverse process, and of the posterior arch, with the contiguous part of the occipital bone; “indeed, the transverse process and the paroccipital are so far blended into a single process that it juts down from the skull and apparently touches the transverse process of the axis, for which it has a facet.”

The articular process and posterior arch, or part of it, may be fused with the contiguous parts of the occiput, while the central part of the anterior arch is separated from the basi-occipital by a small interspace.

In another specimen from the Cambridge Museum, the anterior arch is complete, but has an immature appearance, being developed in the centre and slender on each side where it joins the lateral mass. The interval between the arch and the basi-occipital is a narrow transverse slit. The condyles of the occipital bone and the superior articular processes are perfectly united. The posterior arch is complete and ankylosed to the hinder lip of the foramen magnum. On the left there is no interruption in the fusion of the arch and the occipital bone. The posterior segment of the transverse process is on this side ankylosed with the occipital, behind the paroccipital process, and stretches out to impinge on the paramastoid of the temporal by a convex surface. The costal process is slender and its extremity is joined to the transverse process by a very fine bony spicule.

Professor Macalister refers to the cases of Boxhamer, Somner and Luschka, mentioned by Dr. Allen; and also to a specimen from the Berlin Museum, described by Grawitz,³ in which the posterior arch is fused while the left transverse process is free. In another, from a young child, the posterior arch is completed by a fibrous cord.

The articular processes may be ankylosed to the occipital condyles while the arches and transverse processes are free. This form of synostosis is by far the most frequent, and, according to Macalister and other authorities, is an acquired pathological condition due to osteitic or arthritic inflammations. Among other examples of this most common form of synostosis in the Cambridge Museum, cited by the writer, the skull of an ancient Persian, a middle-aged man, exhibits one that is complete. “There is a wide atlanto occipital gap anteriorly, and the four condylar foramina are normal. The oblique and check ligaments were unossified, and the paroccipital processes are small. There are bony spicules around the ankylosed surfaces, but few other traces of disease. The upper edge of the posterior arch is thick and upturned, extending towards the wide foramen magnum. The whole atlas appears to have slipped a little forward, so that the anterior arch appears to lie on a plane in front of the anterior lip of the foramen, and the plane of the foramen magnum extends behind the prominent posterior tubercle of the atlas.”

The atlas may be attached to the base of the skull by the osseous union of the transverse process with

the jugular process of the occipital bone. A paroccipital process may become lengthened, and in this condition ankylosed with an ascending spur-like process from the axis. Macalister has a specimen somewhat of this form, but in his, the two processes are not ankylosed at their place of meeting.

The paroccipital process may be a descending column, starting from the outer edge of the exoccipital next to the occipito-mastoid suture, and either articulating with the transverse process of the atlas by a flat surface or being ankylosed to it.

Again, cases are recorded in which a styloid process is produced from the posterior angle of the transverse process of the atlas and becomes articulated or ankylosed with a normal paroccipital process.

Examples of these methods of union between the transverse process of the atlas and the neighboring regions of the base of the skull are given by various writers, as mentioned by Macalister. Such cases are dependent upon ossification of the ligamentous structures connecting the several parts.

The following paper by Sommer, is interesting and instructive:

Synostosis of the atlas is not of the rarest occurrence, but it demands special attention when found in a subject whose previous history has been known. With few exceptions the specimens in existence are from individuals whose identity during life had been lost, and the abnormality has been only discovered after maceration, when it was no longer possible to obtain its history. At the lunatic asylum at Allenberg only two instances have been observed where the identity has been fully established. In regard to the rarity of the occurrence of synostosis, there is no doubt that many instances of its presence escape notice, no noteworthy symptoms having presented themselves during life, and even when an autopsy was made, there was no special reason calling for an examination of the base of the skull. Whenever an adequate search has been made in any extensive collection of dissections, these abnormalities have proved to be comparatively numerous. Under these circumstances it has not been possible to establish a percentage of their occurrence. In the entire literature which contains the statistics of autopsies scarcely 20 to 30 undoubted cases of synostosis are published; and while, according to this statement, its occurrence seems to be extraordinarily infrequent, and even to be disappearing entirely, Italian observers, especially Lombroso, with his methodical investigations, have recently found a very considerable number of examples. Among normal male skulls from the collection of bones made at the battlefield of Solferino, Lombroso met with synostosis of the atlas in .34 per cent., which might express the true probability of frequency, in view of the very large amount of material examined. On the other hand, the number which have been found among the skulls of criminals ought certainly to be too large. Lombroso records finding this condition in four out of 51, and his pupil found two in four criminal skulls.

It may be remarked, parenthetically, that these investigators do not think that they are obliged to see any mere coincidence in the above statement, but rather look upon this abnormality as a somatic indication of moral depravity, even as they so regard the presence of a third median groove in the cerebellar portion of the occipital bone. Whether this interpretation is correct, farther investigation can alone show. Moreover, if one desired to suppose that the Italian race was particularly favored in this respect, Rust's old statement could be produced in evidence, which considers inflammation of the spinal cord at the atlanto-occipital articulation, in those cases where the malformation is not congenital, to be traceable to the practice of bearing heavy burdens upon the head. That this custom is more widespread in Italy than in Germany, for example, admits of no doubt, and a greater frequency of inherited synostosis would, therefore, not be improbable.

³ Virchow's Archiv, lxxx, p. 463.

In regard to the two cases in the Allenberg Lunatic Asylum, it may be said that both were diagnosed during life, and the conditions presented were discovered, after maceration, in a search for other anomalies. In 100 lunatic skulls only two cases of synostosis! But, surely, still it cannot be said that two per cent. is a correct ratio of its frequency among lunatics. I give this number with all reservations, and simply remark that in 50 skulls that I have since carefully examined, I have found no cases.

The first of these two Allenberg cases has just been described by Dr. Casprzig, in a dissertation little known; and it was also briefly announced by me in a work upon lunatics' skulls. Here, therefore, I need to give only a synoptical extract describing the relations between the occurrence of synostosis and the health of the individual. The patient, previously quite healthy, was found in his sixteenth year unconscious after a night passed roaming about in the open air. Soon afterwards he complained of violent pains in his head and of anginal symptoms. Then a rheumatic inflammation of the atlanto-occipital articulation evidently arose, which later disappeared, but left behind an ankylosis permitting rotatory movements to a limited degree but which rendered bending and extending the head quite impossible. Moreover, on the third day of the illness, a violent attack of epileptic convulsions, which had not been observed professionally, came on. Afterwards this affection was less marked, but the patient rapidly became insane, and was received at the lunatic asylum as a person dangerous to the public. Here he finally died, at the age of thirty-six. Nothing worthy of note occurred to interrupt the regular progress of his disease, so well known to professional experience.

The second Allenberg case occurred in a girl who was apparently healthy until the fourth year, when epileptic fits were developed. At twenty she lost her mind, and two years later became an inmate of the asylum, where she died at the age of thirty-six. The following conditions were shown at the autopsy: The atlas was rudimentary in its development. The middle portion of the posterior arch was wanting, so that it was only represented by its roots behind the articulating masses. On the right side the synostosis is more extensive than on the left, where the arch is quite free. The anterior arch is fused only at the articulating surfaces. In consequence of the stronger compression of the ankylosed mass of bone on the right side the otherwise normal articulating surface of the axis here stood some millimetres higher than on the other side. The anterior portion of the margin of the foramen magnum, which at the middle is left free, is sharp but in no wise atrophied. Upon the external surface of the basilar portion of the occipital no abnormalities were found.

In conclusion, let me add to the above descriptions, a few remarks from the clinical standpoint. Both skulls belong to the epileptic class. In the first case there is no doubt that after a "cold," an arthritis of the atlanto-occipital articulation was set up and so — as an immediate consequence — epilepsy developed itself. In the second instance every indication of the period when the synostosis may have developed itself is evidently wanting; the commencement of the epilepsy was, however, determined at the fourth year of age. It is most probable that synostosis occurred before this period, because the atlas in this case, the patient being thirty-six at the time of her death, is only in a rudimentary form, and, therefore, an infantile, if not even an embryonic disease of it, is probable.

In both instances, there is in connection with this abnormality a not inconsiderable narrowing of the foramen magnum. Now, Casprzig has remarked, in his above-mentioned dissertation, that Solberg, in several cases of epilepsy, has made the final cause of the convulsions a probable stenosis of the vertebral cord, especially of its uppermost portion, by which the medulla oblongata might be functionally encroached upon. Casprzig accordingly believed that in his case he could refer the epilepsy, almost simultaneously appearing, to the arthritis and to the stenosis of the foramen magnum brought on by it. In regard to the second case of synostosis, likewise an epileptic, the con-

dition is a coincidence to which I allude for the sake of further investigation, without wishing to draw a decided conclusion from the scanty material afforded.

The following case, reported by Langerhaus, is instructive as showing the very early age at which synostosis may occur, while the synchondrosis between the anterior arch and the lateral masses was as yet unossified.

The subject of it was a boy of five years who had generally been in good health, until he was prostrated by scarlet fever and carried to the hospital, where his death occurred from renal complications.

On maceration of the parts a slight asymmetry at the base of the skull was perceptible. Portions of the atlas were not united. The anterior arch consisted of small detached bones which occupied their normal position beneath the middle of the basioccipital. The lateral masses were decidedly congruent. The projections on the right side were very short and ended in a sharp point, while on the left they were somewhat thin and longer and did not reach the anterior rib rudiment. The articulating surfaces were smooth and not fused. The left side of the posterior arch was united with the edges of the foramen magnum by a bony bridge, so that the foramen was bounded on that side by the inner margin of the atlas, and was thus so encroached upon that its form was rendered rhomboidal. The right side of the posterior arch terminated in a sharp point, but otherwise was normally formed. The axis presented no pathological conditions.

The following specimens of atlanto-occipital fusion have lately come under my own personal observation. Unfortunately, the existence of this condition is only made evident after death, when in all the cases that here follow, the identification of the skull with the individual during life was lost and their history before death is therefore unknown.

The skull of the adult female Indian discovered while excavating a sand bank in Chicopee, Mass., and alluded to at the outset of this paper, presented a complete fusion of the right lateral mass and the corresponding half of the anterior arch with the occipital bone. The left portion of the anterior arch remained free. The atlanto-occipital articulating surface upon the right side was reduced in size and flattened. The posterior arch on its right side was much reduced in thickness, and was ankylosed with the margin of the foramen magnum by a thin osseous plate, which, projecting downwards and backwards gave the appearance of an outgrowth from the occipital bone, and thus interfered with the normal contour of the foramen. There was no trace of any portion of the left side of the posterior arch, which had evidently been completely removed by absorption. The basioccipital is considerably asymmetrical. The facet upon the anterior arch, in correspondence with the odontoid, is rather to the right of the centre, thus giving an appearance of a turning in that direction. The amount of absorption which the atlas has undergone in this case, throughout nearly its entire surface, is remarkable.

A skull from the collection of the Biological Laboratory of the Museum of Comparative Zoölogy presents the following conditions: The basi-occipital is nearly symmetrical. The lateral masses of the atlas and the anterior arch, with the exception of a small portion at its centre, are fused with the occipital condyles and the basi-occipital. The posterior arch is

entirely free and a slight diminution in its thickness is evidently due to absorption. The median tubercles of both arches are well developed. This specimen is remarkable for the prominence of all the features presented in well-marked and complete cases of synostosis.

With the assistance of Dr. Dorsey I have examined the collection of the skulls in the Peabody Museum at Cambridge with the following result. Only six cases were discovered among the entire number where synostosis was present even in the smallest degree. The life history of none could be ascertained.

No. 27,290. Stone grave, Brentwood, Tenn. Female, adult.

Both lateral masses are completely ankylosed. The left transverse process is joined to the occiput by a strong bony process which seems to be formed equally by the atlas and the occiput. The posterior arch is entirely free. The anterior arch is completely ankylosed, except for the extent of three millimetres to the left of the anterior tubercle. The left lateral mass projects much beyond the right, and the left articular surface is also considerably larger than the right. The inclination of the ankylosed atlas is such that a line passed through it horizontally would form an angle of 15° with a line passing through the bregma and the alveolar point.

No. 9,185. Female, adult.

In this specimen, the entire atlas, with the exception of the right transverse process, which is ankylosed firmly to the occipital condyle, has been broken away. Owing to this imperfection it is impossible to ascertain to what extent the synostosis had proceeded.

No. 25,132. Female, aged.

Synostosis complete, including the transverse processes. The posterior arch is separated for a space of two millimetres. The alveolar arch is partially absorbed, and this process of absorption has attacked the atlas in certain places, and also the occiput.

No. 13,287. Male, adult.

Both lateral masses completely fused with the occiput, more especially the left. The anterior arch is perfectly free. The right half of the posterior arch is also free.

Ancient skull from a cave in the Sierra Madre, Mexico.

In this case there is no synostosis between the atlas and the occiput, but there is a slight amount between the atlas and the odontoid process of the axis. The central portion of the posterior arch is absent, owing to absorption, a condition which has also produced a cavity in the basi-occipital.

Modern skull from Labrador. Female, aged.

In this specimen the synostosis is slight and imperfectly shown. The posterior arch of the atlas is very delicate, rounded, and absent at the central portion, a condition probably due to absorption.

I have lately received from the Curator, Professor Whitney, the following communication in regard to specimens of synostosis in the Anatomical Museum of the Harvard Medical School.

"The skulls with synostosis of the atlas have been reduced to two, as in one the union was simply accidental. The following is the description: No. 3,590. Of unknown origin, probably female, middle aged. The right half of the atlas is smoothly united to the base of the skull by its posterior arch, which is very much thickened laterally and encroaches somewhat upon the foramen magnum. The articular surface for the axis is flattened, instead of being cup-shaped. There is no roughening or enlargement of the openings for the vessels in the neighborhood. The left half is wanting; to what extent it may have been developed cannot be stated; certainly there was no bony union of the anterior arch. The articulating surface of the condyle of the occiput on the right side is directed outwards instead of backwards and upwards as normally.

This is a case of irregular development, with partial synostosis."

Unnumbered specimen (Dr. Dwight's collection of spines) from a white male, aged twenty-four.

This is a ligamentous preparation, so that an accurate description of the bone cannot be given. There is an evident atrophy of the posterior arch on the left side, with a bony union to the base of the skull. There is no evidence of disease.

The following case, of which I give a synopsis, was published in the *Journal of Anatomy and Physiology*,⁴ by Dr. Thomas Dwight. Although the life history of the subject was unknown, the conditions presented by the specimen were so similar to those of the one reported by Kussmaul, of which I have previously spoken, that it is fair to infer that in the present case, epileptic symptoms might have been induced by any strong movements of the head to either side.

The atlas consisted of three separate pieces. The left lateral mass and the posterior arch reached nearly to the median line. The right lateral mass, with the beginning of the posterior arch and a portion of bone two cubic centimetres long held by ligaments at either end, represent the greater part of the posterior arch; neither of these reach the median line. A small fibrous band between the two sides completes the arch behind. There is no anterior arch whatever; the lateral masses are entirely separate, being, however, connected together by a firm transverse ligament, and also attached to the axis by ligaments extending from the sides of the back of the odontoid to the inner side of the lateral mass. No ankylosis is spoken of. The deficiency of rotation in the atlas is compensated for by the flatness of the occipital condyles.

In regard to the etiology of synostosis, only suggestions can at present be offered. It has been advanced by several authorities, as I have already stated, that this condition is due to arthritic affections, commencing at an early period, the presence of which, however, is very rarely determined during life. Professor Dwight is of the opinion that, in some cases, especially where the arches are separate, the joints become ankylosed through disease; "but, I think," he says in a communication to me, "that in many of the striking cases, in which the arch seems little more than a ridge on the occiput, we must look for the cause in some early disturbance in the development of the spine, such as causes the suppression of a vertebra or occasionally of half a vertebra, or the increase or diminution in the number of ribs."

While there can be but little doubt that, in the occasional cases reported, the epileptic convulsions observed are due to abnormalities discovered only through maceration and after death, we have as yet very little basis upon which to found the theory that their origin depends upon synostosis, either in an incipient or in an established condition. As to the theory, which was originally advanced by Rust and since maintained by Italian observers, that synostosis may be traceable to the practice of carrying heavy burdens upon the head; it should be said that, while this may not be impossible, especially as the greater frequency of this abnormality is stated to be found among the Italian than among other Continental nations—where the custom is not pursued to the same extent—a much larger number of well-established facts must be brought together before synostosis can be proved

⁴ Vol. xxi.

to become hereditary, or that epilepsy is dependent upon its presence as a factor. The same may be said in regard to traumatic causes, such as heavy blows upon the back of the neck, either criminal or accidental, as by snow-slides from houses, injury to the spinal column, by falls upon stairs and sidewalks, to children by falls from bed during sleep, by strains however produced; all of these may cause inflammation that extending upwards, terminates in an anchylosis between the atlas and the base of the skull, to be verified only after death.

INDEX CATALOGUE REFERENCES.

- Toynbee. Abnormal articulation of the occiput with the atlas. *Trans. Path. Soc., London*, 1848-49, vol. ii, p. 93.
 Hussey. Anchylosis of atlas and occiput. *Ibid.*, 1856-57, vol. viii, p. 314.
 Lawrence. *Lancet*, London, 1827, vol. xi, p. 31.
 Struthers, J. Consolidation of atlas and occiput. *Med. Journal*, Edinburgh, 1863.
 Turner. St. Bartholomew's Hospital Reports, London, 1867, vol. iii, pp. 368-370.
 Dwight, Thos. *Journal Anat. and Phys.*, vol. xxi, p. 538.
 Macalister, A. *Ibid.*, vol. xxvii, p. 519.
 Allen, Wm. *Ibid.*, vol. xiv, p. 18.

REFERENCES IN LANGERHAUS.

(Arch. f. path. Anat. un Physiol., cxxi, p. 375.)

1. Sommer. Atlas-Anchylose und Epilepsie. *Dieser Archiv*, Bd. 119, S. 362.
2. Virchow. Beiträge zur physischen Anthropologie der Deutschen mit besonderer Berücksichtigung der Friesen. *Abhandlungen der Königl. Akademie der Wissenschaften zu Berlin*; 1876, S. 340; *Gesammelte Abhandlungen*, S. 972.
3. Hertwig. *Lehrbuch der Entwicklungsgeschichte des Menschen und der Wirbelthiere*, ii Aufl., 1888, S. 461.
4. Henle. *Handbuch der Knochenlehre*, 1871, S. 57.
5. Luschka. *Anatomie*, Bd. 1, Abth. I, S. 86.
6. Solger. Ueber abnorme Verschmelzung knorpeliger Skeletteile beim Fötus. *Centralbl. f. allg. Pathologie und pathologische Anatomie*, 1890, S. 124.
7. Solbrig. *Allgemeine Zeitschrift für Psychiatrie*, 1867, xxiv, S. 1.
8. Kussmaul und Tenner. Untersuchungen über Ursprung und Wesen der fallsuchtartigen Zuckungen bei der Verblutung sowie der Fallsucht überhaupt, 1857, Nachtrag.
9. Casprizg. *Inaug.-Dissert.*, Greifswald, 1874.
10. Sommer. Zur Casuistik der Atlassynostosen. *Dieser Archiv*, Bd. 94, S. 1.
11. Citirt nach Virchow. Beiträge zur phys. Anth. d. D.: *Nederlandsch Tijdschrift voor Geneeskunde*. Amst., 1865. Tweede Reeks, Jaarg. 1, Afd. ii, Bl. 91; und de schedel met ingedrukte Basis, *Akademisch Proefschrift*, Leiden, 1864.

A CASE OF SPONTANEOUS PERFORATION OF THE HEART, WITH OBSCURE SYMPTOMS.¹

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ON the 6th of December, 1894, about six o'clock P. M., I was called to Mr. E., a well-built, well-preserved, strong and active man for his age of eighty-four years, and found him suffering from a severe pain in the epigastric region, the pain extending to the right hypochondriac region. Accompanying the pain were nausea and straining efforts to vomit, with eructations of gas. The pain came on suddenly, and no cause could be traced of over-eating or error of diet. There was a history of a slight slip of his right foot on the ice several hours previous, as he was returning home from his business. There was no rise of temperature; the pulse was full and strong and beating about 80 per minute; the respiration was regular, and no more rapid than would be looked for in any one suffering with pain. No complaint was made of distress in breathing. I found on inquiry that he had

felt well during the day, had eaten his dinner with a relish, had a movement of the bowels and passed water freely. Remembering that some eighteen months' previous, I had seen him in an attack somewhat similar, which was considerably relieved by the vomiting of undigested food, and fully relieved by the after administration of Squibbs' compound tincture of opium, I gave him a mild mustard draught as an emetic. This in a short time caused an easy evacuation of the stomach, a small amount of partially-digested food and considerable gas appearing.

The nausea and straining to vomit was relieved, but there was only a slight relief from the pain. One teaspoonful of Squibbs' mixture, well diluted with water, was then given; and in the course of three-quarters of an hour, the pain was much abated. I left the patient about 7.30, when he was quite comfortable, with respiration and pulse regular and normal. At 9 o'clock the patient was visited again; and as there was some return of the pain, half a teaspoonful of the Squibbs' mixture was given with good effect, and at 10 o'clock he was easy and comfortable. At 3 A. M. I was called in a hurry. I found the patient in a state of collapse, the respiration rapid and catchy; the pulse feeble, intermittent and beating at rate of 120 per minute; the hands and arms, feet and legs were clammy and cold, there was an abundant frothy, watery, bloody, mucous expectoration, with a loud and coarse rattle in the throat on inspiration and expiration, a condition of general edema of lungs; the finger-nails and lips were cyanotic; half a teaspoonful of aromatic spirits of ammonia was given by mouth, and brandy was used hypodermically. The pulse and breathing improved, and these remedies were continued, a steady improvement of the symptoms following, so that in an hour the patient was practically out of the collapse, but he commenced to complain of severe pain.

At this stage I wished to use morphia, but finding the family and patient had an *extreme* prejudice against it, and considering the age of the patient, I gave up the use of it, and concluded to use Hoffmann's anodyne, which would relieve pain and also act as a stimulant of the heart and respiration; so a teaspoonful was given every half-hour, until relief from pain was secured. In two hours' time the patient was so comfortable and all the symptoms were so much improved that I left and went home; the pulse then beating regular and at the rate of 90, the respiration regular and 24; with very little expectoration, and all signs of edema of lungs rapidly disappearing.

I saw the patient again about 10 o'clock, when I informed the family that I did not know what was affecting him and a consultation was desirable. Dr. R. was called, who suggested old man's pneumonia with referred pain, and on examination detected râles on the right side. I admitted the possibility, but demurred, as the pulse and respiration did not point that way, and three-quarters of a degree of fever was rather low for pneumonia. Having nothing else to base a diagnosis upon, that idea was held to during that day and up to the morning of the third day, when another consultation was held with Dr. R. Nothing was brought out this time, and time was relied upon to decide. In the meantime there were intermissions of freedom from pain, though it was gradually becoming less amenable to the Hoffman's anodyne, while it shifted somewhat from the epigas-

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