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ON

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SPINAL APOPLEXY.

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ON SPINAL APOPLEXY.

MORBID affections of the spinal cord and of its investing membranes, more especially those denominated Spinal Irritation, Spinal Meningitis, and Myelitis, are by no means uncommon; but hemorrhage into its substance or theca,—a disease usually distinguished by the name of Spinal Apoplexy—or the *Hématomyélie* of the French, appears to be of comparatively rare occurrence. That this affection should be so infrequent, may perhaps be attributed to the strength of the vertebral column, and its adaptation for the diffusion of shocks sustained by strains and blows; but it must at the same time be kept in view that there is nothing in the anatomical structure, or functions of the cord and membranes, to exempt them from the evil effects of a congested or hurried circulation, and consequently from the occurrence of extravasations. The reverse of this is the case, as Ludwig,¹ J. P. Frank,² Ollivier,³ Hutin,⁴ and others have explained, chiefly from a consideration of the arrangement of the spinal vessels, the absence of a valvular apparatus, and the influence of respiration on the motion of the blood,—as in the case of the brain itself. Besides, although the spinal cord is not the seat of intellect, it is apparently much influenced by mental acts and emotions, and powerfully so by sensations; and hence it is, that in fever and many other maladies,—more especially when the brain is the organ chiefly affected, its medullary prolongation is apt likewise to be implicated, to a greater or less extent, either by direct extension or

¹ *Adversaria Medico-Practica*. Leipsick, 1770. Tom. i., p. 730.

² *De Vertebralis Columnæ in Morbis dignitate oratio Academica*. Paviæ, 1791. Tom. xi., an. 1792.

³ *Traité des Maladies de la Moelle Epinière*. 3 Edit., Tome ii.

⁴ *Nouvelle Bibliothèque Médicale*. Tome i., p. 162

sympathetic action. As the medulla spinalis, therefore, is peculiarly liable to congestion and inflammation, analogy would lead us to expect that, like the brain, it would frequently be the seat of hemorrhagic effusion. Perhaps the supposed difficulty of laying open the spinal canal in *post mortem* examinations, may have prevented a discovery of the real cause of many cases of sudden death, and of paralytic and convulsive disorders; but, be this as it may, the records of medicine have as yet furnished only a few examples of spinal apoplexy; and much evidently requires to be known before a correct diagnosis of this serious lesion can be attained, and before well defined physiological and pathological inferences can be drawn from its varied and interesting phenomena. Such information would also tend to throw light on many of the most difficult and important questions connected with the functions of the cerebro-spinal axis; and it is therefore evidently desirable that no contribution should be withheld which is likely to extend the limits of knowledge on this subject, even although it should be by the production of an isolated case.

At present it is proposed, first, to state the case which suggested this paper, then to make some observations on its symptoms and *post mortem* appearances, and lastly, to give an analysis of the facts on record regarding the disease called Spinal Apoplexy.

CASE.

Mr O., aged thirty years. Was married a year previous to his illness. Habits temperate and active. Was very fond of the amusements of cricket and angling; at the former of which he excelled all his companions in dexterity, and the exertion which he made on many occasions was so great as to be followed by extreme exhaustion. His friends were disposed to ascribe the ill health which subsequently occurred to these fatigues, and to frequent exposure to the night air, and long continued immersion of the lower parts of the body in water while on fishing excursions. He had not, however, been engaged in the former amusement for many months previously; and as to the latter, although angling about a week prior to his illness, he had not then been subjected to much fatigue, nor had he stood at all in the water.

The more probable occasion of his illness was a fall sustained when playing at quoits ten days previously, which hurt his loins a good deal at the time. Be that as it may, for some days previous to his seizure, he was observed to be languid and easily fatigued, a circumstance, however, which did not excite particular attention, as he was subject to bilious ailments. When he awoke on the morning of the 11th July 1843, he found that he had unconsciously voided urine in bed; and on attempting to pass it voluntarily he was unable to do so. Uneasiness from retention, however, was not felt at this time; and after breakfast he went into town to business as usual, without any other complaint. In the afternoon he returned home complaining of continued inability to void urine, and of having felt considerable weakness in his limbs, especially when ascending his own stair. The distension of the bladder by this time must have been great, but was not much complained of. After dinner, however, it became insupportable; and in the evening a surgeon was

sent for, by whom he was bled, and then relieved by the catheter. Next morning the retention of urine was still complete ; and in attempting to rise to the night-stool he dropped suddenly on his knees, deprived of muscular power and sensibility in all the parts below the middle of the dorsal region. In this paraplegic condition he remained until death, a period of two years and seven months.

On the day when these paraplegic symptoms were first manifested, he was twice relieved of urine by the catheter, and had some laxative medicine ; and on the 13th July was ordered to be cupped on the dorsal region by the late Drs Davidson and Abercrombie, both of whom saw him in consultation at this time, and frequently afterwards. From this period until the 13th of February 1844, when he was placed under my care, the treatment chiefly consisted in the application of a succession of blisters along the spinal column, and the use of much purgative medicine and the sulphate of quinine. The catheter was employed for a few days at first, and then discontinued.

For the first two months the inferior extremities were quite supple, and could easily be placed in any desired position, and that too without occasioning pain in the back. Indeed, during this period, he had little suffering of any kind, but afterwards contractions and spasms gradually occurred, and these had reached their greatest degree of strength and severity before I saw him—seven months after the attack. His condition at this period was as follows :— Complete paralysis of the lower half of the body, both in regard of motion and sensibility ; no curvature of the spine, but slight tenderness on pressure immediately above the sixth dorsal vertebra. Motor power and sensibility of the upper extremities quite unaffected, and respiration unrestrained ; a girded or corded sensation at times felt in the epigastric region. Inferior extremities could not be extended beyond an angle at the knee of about seventy-five degrees, but often drawn up on the abdomen by spasms, or could be placed there by a little management. When the limbs were not carefully adjusted in certain positions, or when the soles of the feet were tickled, tremors, twitchings, and contractions of the muscles and limbs were produced, sometimes to a violent extent ; and on these occasions pain was felt in the middle of the dorsal region, and nowhere else. The temperature of the lower extremities was in no degree diminished, but was perhaps rather above the healthy standard ; and sometimes a copious perspiration bedewed the surface.

The urine was passed involuntarily, but at intervals of from half an hour to an hour, and in considerable quantities at a time. The urine itself was highly alkaline, strongly ammoniacal in odour, turbid when newly passed, and afterwards depositing muco-purulent matter of thick and ropy consistence ; and priapism frequently existed to a troublesome extent, more especially when the catheter was attempted to be passed. The fæces were always passed involuntarily, and for the most part contained a large quantity of bile, and were attended with the discharge of much flatus. The action of the bowels had always however to be assisted by purgatives. Over both trochanters were enormous ulcerations with undermined edges, from which afterwards small exfoliations were repeatedly removed ; and there were also small ulcerations on other parts of the limbs occasioned by pressure or any slight irritation. The appetite was in general good, excepting when under bilious attacks, to which he was occasionally subject ; his mind was calm and collected, and his deportment patient. During my attendance, he was seen repeatedly in consultation with Dr Davidson and Professor Syme. The use of the catheter was re-

sumed, but had to be discontinued on account of the spasms which attended the introduction of it. He was placed on the hydrostatic bed to obviate the injurious effects of pressure; the actual cautery was applied along the dorsal region; and a great variety of alterative, tonic, and other remedies, among which may be noticed galvanism, were tried. These means, although of no avail in restoring nervous power, were decidedly useful in protracting existence, and in enabling him to bear up against, and to rally from many severe attacks of bilious fever which reduced him to the lowest degree of weakness. During the intervals of freedom from such attacks, the sores, which were closing up remarkably, sloughed over again to a great extent.

During the summer of 1845, he was removed to the country, and was frequently carried into the open air. He then enjoyed remarkable health, being stronger than at any other period since the commencement of his illness, and became stout in body, although the extremities remained comparatively emaciated. His bowels, although torpid, were more easily managed; the urine had less deposit; and when the limbs were placed in certain positions, he was able at times with a long and urgent effort of volition to move the great toes. This movement, however, at best was very slight, and only noticeable on looking steadily at the parts.

On returning, however, to town in October, he began to fall off in appetite, and to be more frequently troubled with biliary accumulations; and on the 8th February 1846, a severe bilious fever commenced, attended by erythematous inflammation spreading from a small sore on one of his toes to the lower parts of the abdomen. This erythema faded in a few days, producing only slight sloughing action in the ulcerations of the hip, yet his strength gradually declined; and in spite of all the efforts made to sustain it, he died on the evening of the 22d.

The principal peculiarity of his last illness appeared to be the extremely slow process of death. For the last twenty-four hours he was without a pulse appreciable at the wrist, the respiration was slow, the surface of the body cool, and the mind collected and tranquil.

Thirty-nine hours after death, an autopsy was kindly conducted by Dr Bennett. There were also present, Dr John Scott, Dr John Brown, Mr Winget, and myself. Dr Davidson was unavoidably prevented from attending.

The *Vertebral Canal* having been carefully opened, the bones were found to be perfectly healthy, as also were the membranes of the medulla, within which no effusion existed. Corresponding to the sixth dorsal vertebra, the cord presented a greenish black colour to the extent of nearly two inches, and was found to be similarly tinged throughout when a section of it was made. From about one inch above to about five inches below this discoloured portion, extending even to within an inch and a half of the *cauda equina*, the cord was softened, attenuated, and semi-transparent,—altogether deprived of its usual colour, density, and consistence.

On after careful microscopic examination, Dr Bennett favoured me with the following statement of appearances. “The softened and discoloured
“portion of the spinal cord contained numerous compound granular corpus-
“cles, the vessels were very numerous, and coated externally with granules,
“in which corpuscles might be seen embedded. The white nervous matter
“was also greatly broken up forming round globules with double lines. On
“inspecting the cord externally near the pia mater, several minute black lines

“ might be observed, resembling vessels. These, on examination, were found
“ to consist of pigmentary masses, varying in size, situated in the neurilemma,
“ surrounding bundles of nervous tubes.”

In the *Thorax*, the morbid appearances were, here and there, small patches of black carbonaceous deposit in the pleura pulmonalis, in the substance of the lungs, and bronchial glands; very general emphysema of the anterior surface and margins of the lungs; and the heart considerably loaded with fat.

In the *Abdomen*, the parietes presented a very great quantity of fat, as also did the omenta (and indeed the whole body); on the peritoneal lining were several small melanotic-like patches; and attached to the larger omentum were a few tumours, the largest the size of a walnut, and like little spleens. The liver was enormously enlarged, about double the ordinary size, and of a greenish colour throughout. Both kidneys were almost entirely disorganized, presenting abscesses of different sizes communicating with the pelvis of each, and containing besides pus, numerous phosphatic calculi of various forms and sizes from that of a pin head to a large pea or small bean. Several calculi, likewise, were sticking in the ureters, which were much dilated and thickened. A number were contained in the bladder, one being the size of a pigeon's egg, and another about the size of a small bean, was impacted in the prostatic portion of the urethra.

The bladder contained, besides the calculi, a quantity of thick dirty pink fluid; and its surface was generally thickened and roughened at parts, as if by chemical action.

After a careful examination of all the cases of spinal apoplexy which I can find on record, none have been met with in which the *morbid appearances* resemble those of the instance above detailed. There are examples of extravasation of liquid blood alone or mixed with serum into the spinal canal, of blood infiltrated into the substance of the cord, of ecchymosed patches from recent effusion, of coagula circumscribed and diffused, of coagula partially absorbed, of a coagulum surrounded by a distinct filamentous false membrane, and of a dense empty cystic cavity of long standing. Nevertheless, I am inclined to consider the remarkable, circumscribed, dark green coloured portion of the cord in this instance, as affording at once an evidence of the existence, and marking out the locality of a sanguineous extravasation or infiltration. A cyst is not invariably found in old cerebral apoplexies; and the presence of such cannot be considered as an essential character of an apoplectic seizure at a distant date, since there are only two instances recorded, in which the subjects survived an extravasation more than a few weeks, the one of which is reported by Cruveilhier, and the other by Bright (vide table, case 6 (1st attack), and 15); and in both the effusion was external to the medulla. In the case now under consideration, although there might have been an adventitious membrane formed and absorbed during the long period of two years and seven months, without leaving any traces of its existence, yet it is more probable that the blood was at first infiltrated and imbibed into the substance of the cord—breaking up the white nervous tubes as the microscope demonstrated; and that subsequently, under the influence of the

inflammatory process which destroyed so large a portion of the medulla, its colouring matter had undergone an alteration, which produced the greenish hue, and the tissue affected in the course of time, became the seat of pigmentary deposition.

According to Lallemand,¹ and numerous other pathologists, the inflammatory softening of cerebral matter attendant upon sudden congestion in the venous capillaries, occasions a change in colour of various shades of red and brown; and observers in the same field, among whom I may mention Dr Bennett² as not the least distinguished, have shown that softening surrounding extravasated blood assumes various tinges of red, port wine lees, brown, ochre, and green, according to the distance of time which elapses from the period of the accident. Rostan, in particular, notices with regard to the last hue, "that a greenish yellow colour is ordinarily found in the case where the ramollissement *est consécutif à une ancienne attaque d'apoplexie*, and that it is the centre of the softening which presents this colour."³ Analogy, therefore, would lead us to the same conclusions with regard to the changes in the medulla spinalis. When in connexion with the morbid appearances of the cord, the discolouration so well defined and so distinctly marked from the rest of the softened portion, we view the history and symptoms of Mr O.'s case, there will appear the strongest reasons for considering that primarily an apoplectic seizure had occurred,—and from symptoms alone both Dr Abercrombie and Dr Davidson were disposed to view the case in this light. The suddenness of the invasion and the completeness of the paraplegia, without being attended with febrile action, obscure pains in the back or extremities, spasms or tetanic contractions, prove that the case was not one of *myelitis* at first; and the absence also at this period of the same symptoms, but more especially of pain in the dorsal region when subjected to pressure or motion, shows indisputably that no *meningitis* existed. We do not doubt, therefore, that the case at its commencement was apoplectic; and although it may be objected that Cruveilhier,⁴ Grisolle⁵ and others, have remarked that pain of an acute rheumatic character is one of the distinguishing signs of an apoplectic spinal extravasation, yet it must be kept in view that acute pain is not invariably present; that the inference is drawn from a very few cases only; and that analogy with cerebral apoplexies will not permit such a rigid deduction. The most probable explanation of the absence of pain in the back, in Mr O.'s case, prior to or about the time when the bladder and limbs became

¹ Recherches Anat. Path. sur l'Encephale, 1er; lettre, p. 74.

² Inflammation of the Nervous Centres, p. 76.

³ Recherches sur le Ramollissement du Cerveau, sec. ed. p. 158.

⁴ Anatomie Pathologique, tome 1er, art. Apoplexie de la Moelle Epinière, iij. c Livrais. p. 6.

⁵ Traité Elementaire et Pratique de Pathologie Interne, Tome 1er, p. 653.

affected, is, that the extravasation was not so great in extent as to excite irritation of the membranes from simple pressure; and that there was no serious laceration of parts; but that it occurred in the grey substance of the cord, separating rather than tearing the fibres, gradually infiltrating the tissue of a limited portion even to saturation—if I may use the term, and entirely and consentaneously destroying the functions of both the anterior and posterior columns.

Thus, while the symptoms did not indicate that the apoplectic seizure was either preceded or accompanied by inflammatory softening of the medulla, the occurrence of contractions and tetanic spasms in the paralysed limbs afforded positive evidence that this change was subsequently in progress; for it seems well established that these symptoms are the characteristic and diagnostic marks of this action going on, either in cerebral or spinal medullary substance.¹

It was remarkable, however, that this lesion did not take place sooner; for during two months there was complete paralytic suppleness of the extremities before convulsive twitchings of the muscles occurred, and before any degree of pain was felt in the upper part of the dorsal region; and several months more elapsed before these symptoms reached their maximum of intensity.

Having stated my reasons for considering the above case as an instance of spinal apoplexy, I would now make some remarks on the various symptoms and changes which occurred in its progress, and discuss their interesting physiological and pathological relations, did not the space permitted for this communication debar me from attempting more than a brief notice of some of the most important of its phenomena.

The case presents a very remarkable instance of the effect which stimuli applied to the surface of the body produce on muscles of paralysed parts when the integrity of the spinal cord is interrupted by disease. The phenomena occasioned under such circumstances, and the analogous results shown in the inferior animals on sections being made of the medulla, and even when decapitation is performed,² have attracted the notice of Sir Charles Bell, Magendie, Van Deen, Stilling, Dr Marshall Hall, Müller, Volkmann and other eminent physiologists, and led to much ingenious and interesting

¹ Dr Hughes Bennett in an analysis of twenty-six cases of cerebral and spinal softening, satisfactorily shews—"that the occurrence of contraction is a more frequent symptom of inflammatory softening than many suppose."—*Inflammation of Nervous Centres*, p. 29.

² See experiments of Van Deen in "*Traité et Découvertes sur la Physiologie de la Moelle Epinière*," Leide 1841;—and of Stilling "*Untersuchungen über die Functionem des Rückenmarks und der Nerven*," Leipzig 1842. Also an interesting account of the effects produced by decapitation of the land salamander,—*Salamander Maculata*, and of frogs. Müller's *Physiology*, translated by Dr Baly, vol. i. p. 303.

speculation. To Dr Hall in particular belongs the merit of pointing out satisfactorily *the Reflex functions of the spinal cord*,¹ and its capacity for dispensing motor power independently of volition. In the instance under consideration, while so large a portion of the cord, about eight inches, was to all appearance as disqualified for the reception and discharge of sensory and motor influence, as if it had been removed from its place, the most sudden and energetic contractions were produced by gentle tickling of the soles of the feet, without communicating any impression to the mind. This effect proves the independence of the spinal functions under such circumstances; and supports the inference which Dr Budd in his "Contributions to the Pathology of the Spinal Cord,"² draws from some interesting cases of paraplegia, that such muscular movements *vary in extent and force, inversely with the degree of voluntary power possessed by the afflicted limbs.*

It may be interesting here to notice that the priapism, so readily excited by the stimulus of the catheter, is not merely an example of the reflex power exerted independently of an emotional impulse or sensation, but is also a proof of the influence which is thus exercised over a decidedly organic function, namely, that of vascular turgescence.³

But the chief interest of this case, as connected with the functions of the spinal cord, and the theory of reflex power, seems to consist in the following fact. When the patient was moved in bed, unless care and force were employed by his attendants, very powerful contractions were induced in the extremities, the legs flexing forcibly on the thighs, and the thighs on the abdomen, and then a little pain was felt in the upper part of the dorsal region corresponding to the lowest portion of healthy cord in connexion with the sensorium. Now, here appears to be an instance of what might be called a compound or double reflex action. First, the impression is made on the surface, and conveyed along the sensory or *afferent* nerves to the cord, which it affects without any sensation appreciable by the mind, and from thence it is reflected through the motor or *efferent* nerves to the muscles, occasioning contractions. But now having arrived at this stage, how are we to account for the rest of the process, namely, the return to the cord of the impression produced by the contractions, through the same class of nerves which conducted the first impression (the stimulus), and the transmission of it through a large segment of disorganised medullary

¹ Transactions of Medico-Chirurgical Society of London, vol. xxii. xxiii. and xxiv. also, in treatise "On the Diseases and Derangements of the Nervous System," and more lately, "New Memoir on True Spinal Marrow, and its Anatomy," &c.

² Transac. Med.-Chir. Soc. of Lond., vol. xxii. p. 185.

³ *Ibid*, p. 176: also Müller's Physiology, vol. i. p. 225, for proof that erection is caused solely by vascular turgescence, and vol. ii. p. 1483.

substance, to the first healthy portion in the spinal track, there becoming the object of sensation and consciousness.

The point at issue is an interesting and important one, and can only be accounted for in one of the two following ways : either the eight inches of diseased cord, though disqualified for being the residence of sensory power, might yet act as a medium of conduction to an unusually powerful impression, some filaments qualified to transmit nervous influence to some extent still remaining ; or the impression might be communicated through the inosculating filaments known to exist between the spinal nerves and those of the sympathetic system, and thus form a supplementary chain of conduction—a byeway route of sensation in the time of nature's need.¹ Of course, also, by either of these explanations must be tried the phenomena observed near the close of Mr O.'s life, namely, the ability to execute a distinctly noticeable movement of the great toes. This could only be done at times, and in general there was

¹ Although decidedly inclining to the first method of viewing the transmission of sensation in such cases, I shall give the argument for the second explanation, as is well stated by Dr Copland, in his "Dictionary of Practical Medicine"—article "Paralysis." He says, in speaking of those cases of injury to large portions of the cord, which apparently disqualifies it for ordinary functions:—"When we recollect that communicating branches run between the ganglionated or posterior roots of the nerves, and the great sympathetic on each side ; that ganglial nerves may be traced in their course from the sympathetic into the spinal ganglia and cord on the one hand, and from the latter into the sympathetic and ganglia on the other, we cannot but infer, not only that sensation may be transmitted, or more correctly, that impressions on the surface may be conveyed to the brain, so as to excite consciousness, by a different route than that of the spinal cord, especially under circumstances of gradual change in the cord, rendering it ultimately incapable of discharging this function, and that this other route is through the sympathetic nerves, and their communications with the posterior roots of the nerves and spinal medulla. The indirect character of this channel may appear an argument to some against the accuracy of this inference ; but we know that in cases of obstruction to the usual channels of circulation is the vascular system, very circuitous courses are developed in order to preserve an organ or limb, and the nervous system presents many points of analogy with that system, especially a transmission of sensation from the periphery of the body, and from the several organs and structures to the more central nervous masses, and a similar circulation or return of nervous agency in the form of motion and determinate muscular contraction. The analogy may be further pursued, but the several points are so obvious that they require not even enumeration in this place. Moreover, it should be considered, that in respect of sensations excited in any of the abdominal or other viscera, it is very doubtful whether the spinal cord is the channel by which the impressions or changes in the viscera are transmitted to the brain, or whether the sympathetic nerves and communicating branches between the ganglia are the courses which are pursued. Indeed there appears little doubt of the latter being the actual channel of conveyance for impressions on or changes in the viscera, especially those of digestion and assimilation, are as vividly and as rapidly conveyed to the brain, and made objects of consciousness in cases of injury, or even of complete division of the cord, as in sound health."—Vol. iii. part i. p. 37.

a considerable interval between the effort and the effect, the determination of the will, and the transmission of its mandate to the extremities. An accumulation of pathological facts such as these now communicated, will, it is trusted, ere long make this difficult and interesting subject more intelligible.

Whether or not the free nervous communications just alluded to, between the medulla, the spinal ganglia, and the great sympathetic, even become endowed with powers not originally possessed, or become new channels of sensation and volition in extraordinary circumstances, in this case, doubtless, their ordinary functions were much quickened in power for the work of secretion and nutrition. These functions were no doubt to a considerable extent of an abnormal character, as evinced by the large growth of the liver, and the increase of its secretion, the great quantity of fat found in the abdominal parietes, omenta, and under the skin—even of the inferior extremities, and the formation of the splenic bodies found in the abdomen; yet it must be remembered how decidedly he rallied from the prostration of repeated fever; how his body renewed its stoutness; and healthful granulation and cicatrization again and again repaired the ulceration over the trochanters. It was certainly astonishing that with such a diminution of healthful nervous energy, life was sustained so long.

I shall now endeavour to compress into as narrow a compass as possible, the present extent of our knowledge regarding spinal apoplexies. In attempting to do this considerable difficulty is experienced from the information on the subject being much scattered in our medical literature; yet I believe that I have succeeded in gathering together all the cases of spinal apoplexy on record; and those, for the sake of brevity and the more ready perception of inference, are now presented in a tabular form.

From this table I have excluded altogether extravasations in the cord and its theca when occasioned by accident, such as fractures and dislocations of the vertebræ, and blows or strains so violent as immediately to lacerate the vertebral contents—cases, such as have been reported by Morgagni,¹ Sir Everard Home,² Chevalier,³ Payen,⁴ Brodie,⁵ Howship,⁶ and others. I have, also, for manifest reasons excluded instances of sanguinous effusion into the spinal canal—the fluid having forced its way from a rupture in the brain itself; and have also omitted to note any case of simple serous effusion, analogous to those to which, when occurring in the cerebral cavity,

¹ De Sedibus et Causis Morb. Epist., 54, art. 25.

² Philosophical Transactions, May 1814.

³ Transact. Medico-Chirurg. Soc. of London, vol. iii.

⁴ Essai sur l'Encephalite Thèse de Paris, 1826, p. 21.

⁵ Transac. Medico-Chir. Soc. of Lond., vol. xx. p. 147.

⁶ Discrimination and Appearances of Surgical Disease, p. 77.

the name of serous apoplexy has been applied. I have therefore limited the selection of cases, strictly to spontaneous hemorrhage of the medulla and its membranes. But in the table now presented I have included extravasation of the *medulla oblongata*; for although that part presides over a special function, namely, respiration, although in it decussation commences, and although it does not lie in the vertebral canal, it must be regarded as the cerebral portion of the cord, and consequently must have a place in the arrangement.

Hemorrhage of the *annular protuberance*, however, is not so classified, for although M. Ollivier has arranged such cases under the general title of *Hæmatomyélie ou Apoplexie de la Moelle Epinière*, this portion of the cerebro-spinal system bears neither an anatomical nor physiological resemblance to the medulla spinalis. As some, however, may approve of Ollivier's arrangement, I may mention in general, from a survey of the cases reported by himself, by Serres,¹ Cruveilhier,² Cheyne³ and others, that extravasation in this situation appears to be much more frequent than in the spinal cord, contrary too, from what might have been expected considering the density of texture; that its seat is in the grey substance, sometimes circumscribed—from the size of a nut to that of a pouch-like bulging out of the whole protuberance, but in nearly an equal proportion of cases, producing rupture, and spreading into some part of the brain, or into the medulla oblongata—as it did in one instance; that its subjects are commonly old people, and males; that, with age, debility of constitution seems to be the most common predisposing causes; that the attack is sudden, and a fatal result nearly immediate, although in a few cases there is time for complaint of giddiness and sickness, without the ability of speech; and that the progress of the lesion is distinguished by insensibility, with stertorous breathing of the pipe-blowing character, complete paraplegia (in one instance, however, the cross effect was observed) alternating or intermitting with epileptiform convulsions, and death,⁴ as if from asphyxia, within a few hours from the period of seizure. The most marked diagnostic signs of apoplexy in this situation, therefore, appear to be a sudden invasion with loss of speech, insensibility, paraplegia alternating with epileptic movements, and an overwhelming of the respiratory function, which, however, appears to be principally occasioned by pressure on the medulla oblongata.

It is to be regretted that some of the sixteen cases of spontaneous

¹ Annuaire Medico-Chirurg. des Hôpitaux, p. 351, &c.

² Dict. Med. et Chirurg. prat. tome iii., art. "Apoplexie," p. 239.

³ Cases of Apoplexy and Lethargy, p. 102, &c.

⁴ If the extravasation is to a small extent and without lacerating, but merely separating the fibres, life may be prolonged and absorption take place. Vide Cases of Serres, also Ollivier, p. 160-166.

spinal extravasation given in the accompanying table, are not reported by their respective authorities, with the precision which would have been desirable for correct analysis; but notwithstanding these faults, the data given appear to warrant the following inferences.

1st, Spinal apoplexy occurs at all periods of life, but is least frequent in infancy, and most in the middle aged.

2d, In the largest proportion of cases, males are the subjects of it.

3d, Its progress to a fatal termination is in general rapid; almost immediate when the medulla oblongata is its seat: a few hours or days when it occurs high up in the column, or the quantity effused is great; but life is sometimes protracted when it is to a limited extent in the lower part of the cervical or in the dorsal regions (cases 6, 1st attack, 15, 16), for in the first instance, the patient survived the extravasation five years, in the second, one year, and in the third, two years and seven months.

4th, Its situation and extent is various. Sometimes it occurs between the bones and membranes, (cases 4, 13), or between the membranes, (cases 1, 2, 3), or under the pia mater, but external to the cord, (cases 11, 15), or in the grey substance as most commonly happens, (cases 5, 6, 7, 8, 9, 10, 14, 16). It is of comparative rarity in the cranial portion of the cord, which appears remarkable when the frequency of extravasation in the annular protuberance is considered; it is of nearly equal frequency in the cervical and dorsal regions; and is least common in the lumbar region. The blood is occasionally mixed with serum, sometimes pure and fluid, but generally coagulated; sometimes it is diffused over a large extent of surface, sometimes circumscribed, assuming the form of small defined clots. These clots are sometimes destitute of any cystic formation, even after the lapse of twenty or thirty-four days (cases 7, 14), in other instances they appear to have been surrounded by a well-formed adventitious membrane (cases 6, 15); and in the first of these cases, at an interval of four or five years, the cyst was found empty, and in the second, were contained only the broken remains of a coagulum. Sometimes the blood is found infiltrated in the median line of the cord, or in one of its two halves, or through its entire thickness, merely separating the medullary fibres; but in other instances a portion, (case 5), or even the whole cord, (case 2), both white and grey substance, may be completely broken up. In one case (6, 2d attack), we have an example of ecchymosis after an interval of twenty or thirty days, yellow coloured, extending along the whole length of the cord; and in another case (16) an instance at the distance of two years and seven months, of a dark green discoloration from some change in the colouring matter of the blood.

5th, The causes of spinal extravasation both predisposing and exciting, are imperfectly known: the most probable, however, of the

predisposing causes are, a strumous and rheumatic diathesis, long continued dyspeptic derangement, and the previous occurrence of cerebral apoplectic seizures, or the existence of organic disease of the brain; and the most probable of the exciting causes are, over exertion, fatigue, and strains affecting the vertebral column.

6th, The premonitory symptoms are neither well marked nor invariable. The most ordinary general indications, appear to be headache, languor, and debility; and the most common local signs, are various degrees of pain corresponding to the part where the extravasation is about to occur, or along the course of the spinal column; stiffness of the neck, and pains in the arms, when the cervical region is the part affected; feebleness of the legs, and tendency to sickness on the erect posture being assumed; and difficult micturition, when the dorsal and lumbar regions are implicated.

7th, The matured symptoms are usually, but not always, a sudden invasion or increase of pain—but without any acceleration of pulse, corresponding to the seat of the extravasation, suddenly followed by paraplegia, sometimes with convulsions; and when death does not result within a short period, spasmodic contractions, sloughing of the nates or other parts, and the usual symptoms of paraplegia from inflammatory softening of the cord occur.

8th, The *pain* felt is at one point of the spine only, when the extravasation is limited in extent, (cases 6, 12 (?), 14, 15), but along the whole of the column when the effusion is more general (cases 2, 7, 13). It is most acute when the extravasation is external to the cord, producing by pressure irritation of the membranes (cases 2, 3, 4, 6); it becomes extinct when the cord is compressed, and its functions annihilated (cases 2, 6, 7, 12 (?), 14, 15); and is absent altogether when the extravasation takes place gradually in the grey substance, without lacerating the nervous filaments, or subjecting the membranes to pressure (case 16).

9th, The *paralysis* invariably occurs to some extent, and affects all the parts supplied by the spinal nerves below the seat of the extravasated blood. It may assume the form of *hemiplegia* when a small extravasation, by compressing a portion of the cord on one side, enfeebles or abolishes altogether its motor and sensitive functions (cases 6 (*first attack*), 15);¹ and when this occurs, a *direct* effect is produced—a term used in contradistinction to that of a *cross* effect, which is invariably observed in cerebral apoplexies. The precise extent, too, in which the anterior and posterior columns

¹ In noticing this case Dr Bright remarks, “that the propagation of excitement *from* the left column of the spinal cord to the right hemisphere of the brain, furnishes an interesting illustration of an occurrence which usually takes place in the opposite order of succession, and affords additional evidence that the corresponding halves of the central mass of the nervous system decussate in the medulla oblongata.” At the time of seizure this patient’s mind and speech were a little affected, and all the muscles of the left side of the body. On examination after death, the brain was sound.—Medical Reports, vol. ii. p. 339, &c.

of the cord may be ruptured or compressed, relative differences are observed in regard of sensibility and motion in the limbs of the same, and of opposite sides of the body, producing what might be called—notwithstanding the seeming contradiction of the term, a *hemiparaplegia*. Very interesting examples of this variety of paralysis are presented in cases 6, 7, and 14. But, as may be supposed, from the small bulk of the cord, and the proximity of the roots of the different spinal nerves to each other, the most common result of an extravasation is paraplegia, affecting equally the motor and sensory nerves, and both sides of the body consentaneously; and this also will account for the easy transition of a hemiplegic case to one of paraplegia. Along with paralysis of the inferior extremities, the rectum and bladder are likewise deprived of voluntary power; and it is worthy of remark, that the state of the latter organs generally afford the first indication of the approach of paraplegia.

10th, The *sensorium* is quite unaffected in apoplexy of the vertebral portion of the cord; but *insensibility* is an almost immediate result when extravasation occurs in the medulla oblongata (cases 8, 9, and 10); and the same effect may be expected when an effusion in the spinal canal reaches so high as to subject this part of the cord to pressure—as was probably the action in case 12.

11th, *Respiration* is not affected in apoplexy of the lower half of the cervical portion of the cord, for although the intercostal muscles, and the muscles of expiration are paralysed, the diaphragm carries on the work. When, however, the extravasation is in the medulla oblongata, the respiratory function is immediately affected, and death by asphyxia speedily ensues (cases 8, 9, and 10); and this result, too, is likely to take place in the affection of any part of the cord above the origin of the phrenic nerve (case 11 (?)).

12th, *Convulsions* may occur when no inflammatory action has been present (cases 3 and 4), and appear to originate from reflected cerebral irritation—such as occurs in the course of many non-inflammatory affections.

13th, *Muscular contractions, spasmodic twitchings, and tetanic rigidities* are consecutive to the apoplectic seizure (cases 6 and 16), and must be regarded as signs of various degrees of inflammatory softening of the cord.

14th, *Meningitis and myelitis* have in several instances occurred subsequently to extravasation (cases 7, 14, 15, and 16) either conjointly (case 14), or independently of each other (cases 5, 7, 15, and 16). There is no evidence, however, that meningitis has ever been antecedent to an extravasation, although myelitis has probably been so (case 5).

15th, In cases of apoplectic paraplegia which become chronic, the pathological states are identical with those of paraplegia originating from ordinary causes. Of those we may notice especially the sloughing of the nates over the sacrum and trochanters (cases 6, 7, 15, and 16); the disorganization of the kidneys, ureters, and

bladder (cases 7 and 16), with remarkable alkalinity of urine; the morbid action of the liver and digestive apparatus; the elevation of the cutaneous temperature; and the slow and tranquil death (cases 6, 7, 14, 15, and 16).

Although there cannot be selected from the foregoing inferences a precise pathognomonic mark by which to distinguish a spinal apoplexy, yet I think that a sufficiently correct diagnosis may be given of the affection. If all the parts of the body below a certain point in the spinal tract have become suddenly paralysed, more especially, as is generally the case, if pain has been suddenly felt at this point, immediately previous to the occurrence of the paraplegia; and if it is found that the spine has sustained no concussion, that there is no affection of the sensorium, of speech, or the muscles of the face, and that no fever, muscular spasms or contractions are present, then, there is every reason to conclude that sanguineous extravasation has taken place.

The suddenness of the attack is the chief feature of distinction from a morbid growth pressing upon the cord; the unimpaired intellect and the paraplegia will distinguish it from cerebral disease; and the non-existence of fever at first; of pain after the palsy is complete, and of spasms, contractions, and rigidities in the early progress of the case, will serve to discriminate it from inflammation of the meninges, or of the medullary substance.

The *treatment* of spinal apoplexy may be disposed of in a few words; for the objects to be sought, and the means employed, are such as are generally approved of in cerebral hemorrhagic extravasations. To take off the weight of the circulation, so as to prevent further extravasation, and the occurrence of inflammatory action, absolute rest, and general and local bleeding, are evidently of primary importance; and such derivatives as act freely on the mucous and cutaneous surfaces, ought to be good auxiliaries. But the use of all active means would require the greatest attention to the state of the patient's strength. And in seeking to effect the next object of treatment, namely, the absorption of extravasated blood, the knowledge of the feeble degree of nervous energy and vital cohesion retained in the paraplegic state, should deter from an incautious use of mercury, iodine, or counter-irritation, and a good deal rather be trusted to the *vis medicatrix naturæ*. The main endeavour should be to nurse and sustain the patient's strength, and to guard against the influence of those causes which are most likely to occasion additional disturbance of so many important organs and functions. This will be best accomplished by suitable diet, tonics, and gentle aperients; and while the catheter is used when circumstances permit, to diminish the tendency to disorganization of the coats of the bladder, the patient should be laid, if possible, on the hydrostatic bed, to preserve the cuticular surface from injury, which might ultimately hasten on a fatal result.

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No. of Case	Sex and Age	Supposed Cause	Symptoms	Duration of Illness	Seat and extent of the Extravasation	Other Morbid Appearances	Authority
1	m. adult	Not mentioned	Comatose, but apoplectic, but mental faculties unimpaired.	Not given.	Spinal death; a large quantity.		DuRoi, Hist. de l'Anat. de la t. t. p. 47. Annot. 1815.
2	m. 61	A long journey	Pain along the whole spine, specially followed by paraplegia, commencement of urine and feces, which the physician tried to draw, but which he could not.	A few hours.	Spinal death; extensive—all below 3d lumbar vertebra, and substance of cord broken up.		Guérin, de Chery, Mémoires Méd. de la Faculté de Médecine de Paris, t. 10, p. 102.
3	f. 14	Not mentioned.	Pain of head and back in lumbar region, with stiffness and fever for five days; then sudden increase of pain, and convulsion lasting for five or six hours.	3 days.	Spinal death, in lumbar region, filled with blood not uniform in thickness, and imperfectly organized. The extravasation extended upwards first at the commencement of the illness, and then to a greater extent when the convulsions took place.		Chomley, Transac. Med. Soc. Chir. Soc. of Lond. vol. iii. p. 102.
4	— 7 days	Unknown.	Refused milk for two days, and died five days afterwards, convulsions for two days.	4 days.	Between 6th and 7th dorsal, in cervical region; a firm coagulum.		Alcock, Dis. of Brain and Spinal Cord, 1829, p. 245.
5	m. 79	Typhoid fever, with loss of teeth.	Was found dead in bed.	(?) few hours.	Grey substance—One extravasation along the 4th dorsal vertebra, and another the size of a filbert on a level with the 4th dorsal vertebra. The extravasation was of grey substance. A little surrounding softening, and considerable general softening.	Membrane of brain highly inflamed. Small superficial extravasation in anterior part of left hemisphere. In some parts of the brain were slight cysts about the size of a pea, and containing a little yellow fluid.	Alcock, Dis. of Brain and Spinal Cord, 1829, p. 245. Virchow, Virchow's Archiv, 1858, p. 178.
6	m. 22 1st attack 27 2d attack	Unknown.	Acute pain in neck, and constant in three months. Right leg numb and cold. Recovered in three months.	Nearly 5 years after the first attack.	Grey substance; three distinct extravasations, 1st, strongly encysted, size of an almond, between the 4th and 5th dorsal, and 6th cervical, across of left side, raising the posterior layers, probably of four years' date; 2d, of grey substance, of perhaps twenty or thirty days date; 3d, coagulated blood filling the whole of the canal formed by the white substance.		Crovelley, Anat. Path. tom. 1st, ill. 17, 18, 19, 20, 21, 22, 23, 24, 25.
7	m. 29	Not mentioned.	Shivering, pain along the vertebral column and in the neck, and in the right leg. Right leg numb and cold. Mind clear and tranquil. Large tubercles over os sacrum, gurgulous vomiting and slow death.	34 days.	Grey substance, in right side, at origin of 1st dorsal nerve, to extent of 24 inches. Infundibular also, of fluid blood into grey matter, and into the canal, in the posterior part of the canal, nearly to the point of termination.	Abatement of hydrocephalus; and the writers and bladder ulcerated.	Mémoires de la Société Anatomique, No. xviii. p. 245.
8	f. old	Emphysematous disease of brain.	Ordinary symptoms of cerebral apoplexy, but as if apoplectic.	Immediate.	Grey substance of the medulla oblongata—three small extravasations.	Extravasation of brain.	Billard, Traité des Maladies de la Moelle Epinière, 2e éd. Tom. II. p. 123.
9	f. 64	Long continued bad health, hysterical, and delirious.	Ordinary symptoms of cerebral apoplexy; it entered a cry in the wall, and fell down insensate.	Immediate.	Grey substance of the medulla oblongata, a quantity of bloody serum filled the canal.	Great engorgement of the vessels of the brain.	Guérin, de Chery, Mémoires Méd. de la Faculté de Médecine de Paris, t. 10, p. 102.
10	m. 55	Unknown.	Fell down suddenly with epileptic movements in the extremities, in which state he remained for three or four months; could not speak. Respiration at first extraneous, soon became embarrassed (stertorous); and general paralysis ensued.	2 or 3 hours.	Grey substance of medulla oblongata; at origin of 4th cervical nerve. A part ruptured, and blood escaped into 4th ventricle of the brain.		Reynold, Journ. Med. Soc. Lond. Tom. II. 1823.
11	f. adult	Syphilitic disease of the cervical vertebrae.	Weakness and pain in moving neck, which followed by spasm. On 3d day, severe pain and trismus contraction of muscles of the neck, and of the face. On 6th day, palsy of left arm; convulsions of all the limbs; difficulty of respiration, delirium; and then general paralysis.	8 days.	Under the matter—surrounding cervical portions of cord was a coagulum of dark blood, of the size of a hazel nut. A part ruptured, and blood escaped into 4th ventricle of the brain.		Leprieux, Arch. Génér. de Méd. Année 1849.
12	m. 29	Exposed to the heat of the sun.	While walking experienced great faintness, and acute pain in the neck. Fell down insensate, and died on the 3d day with symptoms of apoplexy.	3 days.	No extravasation, but Oliveira (l. c. p. 199) considers the case beyond doubt, as one cerebral vessel, deriving its blood downwards, addressing towards the medulla oblongata.		Collins, Anat. Clin. de Méd. Février 1838, Tom. I. p. 131.
13	m. 12	Jack 10 months previous to the present illness, while swinging.	After a lapse of some months, became stiff in the neck, and unable to move the neck. Ten months after the injury there was paraplegia of the lower extremities, and the patient died four days before death, he was suddenly seized with pain in the back.	A few days.	Between 6th and 7th dorsal, a large quantity of dark blood, of the size of a hazel nut, was found. A part ruptured, and blood escaped into 4th ventricle of the brain. No extravasation of cord.		Humboldt, Journ. de Méd. et de Chir. p. 115. Also in Dictionnaire de Médecine, t. 10, p. 73.
14	m. 40	Unknown.	Sudden acute pain between shoulders, continued for three or four days before death had insupportable pain in back of neck; and then followed delirium, and death. The patient was found later, but was in the former. Intelligence unimpaired. Slow death.	20 days.	Grey substance, a dark clot, the size of an almond, was found between the 6th and 7th dorsal vertebrae, and to the extent of two inches. A dark green deposit, of the extent of about one inch above, and below the first vertebra below the highest extravasation; membrane reddish black to extent of three inches, and with slight softening.		Guérin, Journ. de Médecine, Année 1838, p. 32.
15	m. 48	14 years of bad health, with consumption, & dyspepsia.	Mind and speech a little affected, slight paraplegia of the lower extremities, and acute disease and prostration of the lower extremities. About two months before death, paraplegia of the lower extremities, and prostration of the lower extremities. Singling of voice. Slow death, respiration surviving all the other functions, and terminating in a peaceful and intelligent aspect.	1 year.	Under the matter but external to the cord, were the red and broken remains of a coagulum of dark blood, of the size of a hazel nut. It corresponded to the cord. Membrane in this part vascular, and there was no disorganization of the cord.		Stead, High's Medical Reports, Vol. II. p. 329.
16	m. 29	Frequent bilious derangement; attacks of vertigo; and attacks of back 10 days previously.	Lagune retention of urine, and soon afterwards (within a few hours), complete paraplegia of all the parts below the neck, and loss of consciousness, and inability and motion, and incontinence of urine and feces. The patient died after a few days, with occasional pain in the upper part of the back, and occasional bilious vomiting attacks. Suffering over the whole of the illness, but was discharged to the last. Process of death slow.	2 years and 7 months.	Between 6th and 7th dorsal, a large quantity of dark blood, of the size of a hazel nut, was found. A part ruptured, and blood escaped into 4th ventricle of the brain. No extravasation of cord.	Lower meninges and engorged. Abundant deposit of dark green deposit, of the extent of about one inch above, and below the first vertebra below the highest extravasation; membrane reddish black to extent of three inches, and with slight softening. Membrane perfectly healthy.	The case detailed in this communication.

