Probationary essay on spina bifida : submitted ... to the examination of the Royal College of Surgeons of Edinburgh when candidate for admission ... / by Patrick S.K. Newbigging.

PROBATIONARY ESSAY

ON

SPINA BIFIDA,

SUBMITTED,

BY AUTHORITY OF THE PRESIDENT AND HIS COUNCIL,

TO

THE EXAMINATION

OF THE

Royal College of Surgeons of Edinburgh,

WHEN CANDIDATE

FOR ADMISSION INTO THEIR BODY,

IN CONFORMITY TO THEIR REGULATIONS RESPECTING THE ADMISSION OF ORDINARY FELLOWS.

BY

PATRICK S. K. NEWBIGGING, M. D.

OF THE UNIVERSITY OF EDINBURGH.

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To.

A. Burt Esq

With

The Authors best Compts

TO

WILLIAM NEWBIGGING, ESQ.

F.R.S.E., &c. &c.,

FORMERLY PRESIDENT OF THE ROYAL COLLEGE OF SURGEONS,

THE FOLLOWING ESSAY IS INSCRIBED,

AS A MARK OF RESPECT FOR HIS PROFESSIONAL CHARACTER,

AND AS A TRIBUTE OF AFFECTIONATE REGARD,

BY HIS SON,

THE AUTHOR.

TO

J. W. TURNER, ESQ.

F.R.S.E., F.R.C.S.E., &c. &c.,

PROFESSOR OF MEDICINE AND SURGERY IN THE UNIVERSITY OF EDINBURGH,

THIS ESSAY IS DEDICATED,

IN TESTIMONY OF RESPECT FOR HIS EMINENT ACQUIREMENTS, AND TALENTS AS AN INSTRUCTOR,

AND OF GRATITUDE FOR PRIVATE FRIENDSHIP.

BY

THE AUTHOR.

ON

SPINA BIFIDA.

HYDRORACHIS,* Spinola,† and Spina Bifida are names which have been applied to a disease situated in any portion of the spinal column, from the atlas to the coccyx, characterized by one or more fluid tumors, arising from an incomplete ossification of the spinal canal, and attended generally with some paralysis of the sphincters and lower extremities. Some authors, and in particular M. Itard,‡ have objected to denominating this affection Spina Bifida, and prefer the term Hydrorachis, as conveying a more accurate idea of the disease; but as this term merely means dropsy of the spinal column, without signifying any solution of continuity of the osseous texture, I have adopted the term Spina Bifida, which, in my opinion,

* Sauvage, Nosolog. Method.

† Linnæus, Genera Morborum.

‡ Dictionnaire des Sciences Médicales, vol. xxii.

is the least objectionable, and certainly is the one most commonly employed.

The first accurate account of this disease was given in 1652 by Tulp,* who describes it very minutely, and mentions having seen six cases of it. We cannot, however, suppose that a disease characterized by such striking symptoms was unknown to the ancients; and indeed we have the authority of Mr. Samuel Cooper,† and of the author of the article Spina Bifida in the Encyclopédie Méthodique for stating that it was known to the Arabians; but into this subject it is unnecessary to enter at present. After the description of the disease given by Tulp, we find frequent mention made of Spina Bifida by medical authors, particularly Genga, Hoffman, Ruysch, Acrell, Morgagni, Camper, Fleischmann, Cooper, and Abernethy. The list might easily be extended to a much greater length, but those who are interested in the literature of a disease so deserving of the attention of the profession, from its fatality, I would take leave to refer to a Thesis on the subject by Moeckel,‡ a work which, like those of most of his countrymen, is characterized by deep and persevering research.

* Obss. Med., lib. iii.

† Surgical Dictionary.

‡ De Hydrorhachitide, 1822.

Authors have divided Spina Bifida into two classes, *Complete*, and *Incomplete*, according as the whole of the vertebral column, or part of it, is divided. It is denominated *complete* when the fissure of the column extends from the atlas to the coccyx; but this, it needs scarcely be remarked, is a rare occurrence. The other is the form of the disease which is generally presented to the observation of the surgeon; and of this we have various subdivisions, according to the situation of the tumor, such as cervical, dorsal, lumbar, &c. &c.

It is my present intention to speak chiefly of *Incomplete* Spina Bifida, as the most important to the practical man; and to mention merely incidentally what I may deem it proper to say respecting the *complete* form of the disease.

SYMPTOMS.

Spina Bifida may be said to be always congenital; at least such is always the state of the vertebræ which gives rise to it. In a few cases, indeed, it has not been observed for some days after delivery; but it is evident that the ossification must have been imperfect from the first, and that some exertion of the

child produced the tumor. It may be remarked, however, that Lancisi saw Spina Bifida declare itself in a child at the age of five years; and Opin of Altsdorf assures us of a case which did not appear before the age of twenty; but such cases, if they have really occurred, are extremely rare,—so much so as to permit us still to call this a congenital disease.

It is remarkable that in an affection in which the most delicate and important parts, and those most essential to existence are implicated, the symptoms are by no means entirely the same in any two cases; but the cause of these differences it will be more convenient to state under the head of Pathology.

I have stated in my definition that Spina Bifida presents itself in the form of a tumor on the vertebral column, with or without paralysis of the sphincters and lower extremities; but although this may be sufficient for a definition, as conveying the prominent symptoms of the disease, it is necessary to mention under this head other peculiarities. This tumor, then, is found sometimes merely like a pink-coloured spot, scarcely elevated above the surrounding surface, and conveying a feeling of fluctuation; or it may be globular, like a bursa, with either a broad base or one pedunculated and pyriform. It varies in size from the scarcely elevated point above described, to that of a child's head; but its general dimensions are

about those of a small orange. When covered by the common integuments, it may be opaque or translucent, soft, tense, or fluctuating,—these characters chiefly depending upon its contents. Sometimes also the integuments are the seat of inflammation going on to ulceration or gangrene. The tumor is generally situated in the lumbar region, although it may occur in any part, the next most frequent seat of it being the dorsal region, while the cases of it in the cervical, sacral, and, as some say, coccygeal regions, are nearly equal in point of rarity. For the most part, little complaint is made by the patient, unless when the tumor is pressed upon, either by lying on it, or by the hand of another, when stupor has been observed to result; when, however, it is inflamed, it is scarcely necessary to mention that there is considerable pain and constitutional irritation. It is observed that during perturbed respiration, as when the child cries, the sac is inflated; that in those rare* instances where two tumors are present, pressure on the one affects the other; and that pressing on the fontanelles of the cranium, particularly in hydrocephalic subjects, visibly dilates the tumor. Another symptom, also sensible to the touch alone, unless when the tumor is very large, is an anormal space existing in some part of the course of

* Camper, Dissert. de Hydrope.

the spinal column, and marking the situation where the tumor and vertebral canal communicate with each other,—a lesion which may be considered as almost pathognomonic of this disease.

The symptoms which may be termed constitutional, and arising from the local affection, are debility and emaciation of the lower extremities, depending upon a deficient conveyance of nervous energy to the muscles. Complete paralysis of the bladder and rectum, as well as of the lower extremities, is sometimes observed, although these symptoms are by no means so constant as might have been supposed from a review of the pathology of this affection. The child is unable to suck, its deglutition being impeded, and it lies in a comatose state, sometimes with convulsions, which last symptom is generally the forerunner of death. Spina Bifida is not unfrequently coincident with other diseases, marking an arrest or perversion of developement, such as faulty formation of the intestines, imperforate anus, absence of a kidney or testicle, harelip, clubfoot, morbus cæruleus, &c. Chronic hydrocephalus is also sometimes present, aggravating the disease, and rendering any treatment adopted for the removal of Spina Bifida nugatory. Some authors, indeed, have considered Spina Bifida as merely the accompaniment of hydrocephalus,—so frequently are the two diseases united

in one subject. On the other hand, it sometimes happens that the child is in every other respect well formed and healthy when Spina Bifida is present, as in cases recorded by Morgagni,* Fleischmann,† Cooper,‡ and some others.

The diseases which might perhaps be confounded with Spina Bifida are, caries of the vertebræ, morbid growths, &c.; but these can scarcely lead the surgeon into error if he consider the prominent symptoms already stated.

THE PROXIMATE CAUSE OF SPINA BIFIDA.

As a multitude of hypotheses declare a subject to be uncertain and undetermined, so the proximate cause of Spina Bifida may be said to be still a matter of speculation.

Tulp supposed that the imagination of the mother, or a blow during pregnancy on the region of the spine, might produce this malady in the child; but it is the prevalent opinion at present that the diseases of infants, attributed by many in former times

* Morgagni, de Sedibus et Causis Morborum.

† Fleischmann, de Vetiis Congenitis, 1816.

‡ Cooper, Surgical Dictionary.

to such causes, are merely to be considered as remarkable coincidences.

Hoffman supposed that Spina Bifida was caused during delivery, from too great pressure being made on the head ; but this could not produce the solution of continuity in the vertebral column, however competent it might be in the case of hydrocephalus to project the fluid from the brain into the spinal canal ; indeed, the fact of the integuments of the tumor seldom collapsing to their former state after the removal of the fluid, is an argument against this opinion. Morgagni * indeed, Acrell,† and some others, state that Spina Bifida is never present without hydrocephalus ; but although the simultaneous occurrence of the two diseases is frequent, it is unquestionable that cases occur where no such combination takes place.

The opinion adopted by Olivier,‡ Andral,§ and others, and the one which I am inclined to follow, is, that Spina Bifida depends on an arrest of developement in the osseous texture of some portion of the vertebral column during fœtal life ; and what I have stated as to the frequent presence of other mal-

* Morgagni, de Sedibus et Causis Morborum.

† Acrell, Mémoire de l'Academie Suède.

‡ De la Moëlle Epinière, par Olivier, 1824.

§ Andral, Précis d'Anatomie Pathologique.

formations, marking imperfection of developement along with Spina Bifida, is decidedly in favour of this opinion. I do not pretend to trace this cause farther back, as some have done, attributing such errors in Nature's works to the uncomfortable position of the fœtus in utero, and so forth,—being contented to assume such arrest of developement as an ultimate fact in physiology. Mr. Samuel Cooper mentions that the Arabians attributed this defect in the spinal column to the presence of the tumor; but it need scarcely be stated that in this they mistook effect for cause,—the tumor evidently not causing the separation of the vertebræ, but being itself the result of such separation. So absurd, indeed, were the opinions in ancient times as to the etiology of this disease, that the tumor was supposed by some to be a continuation of the urinary bladder, and the presence of the straw-coloured fluid was thus accounted for.

It is useless to dwell longer upon the many absurd hypotheses which have been at various times broached concerning this disease; but it may be proper, before concluding this part of our remarks, to mention the opinion of Neuendorf,* who supposes that, in consequence of some partial affection of the dura mater in the spinal column, a fluid is ex-

* Neuendorf, Dissert. de Spinæ Bifidæ Curatione.

haled, which, by preventing the formation of the vertebrae, at once produces the deficiency in the spine, and the fluctuating tumor. This hypothesis is based upon the supposed fact of the bones of the cranium and vertebrae being not only nourished, but formed by the dura mater,—a fact than which none is more disputed, and on which few are found to agree. The doctrine is nevertheless plausible, and were it of essential importance to come to a decided opinion upon a subject which, although in itself interesting, is of little practical utility, I should certainly examine it more minutely than I have done; but it appears to be sufficient for my present purpose to rest satisfied with the ultimate fact already stated. The cause of the accumulation of the fluid giving rise to the characteristic mark of the disease is not very apparent, but it is probably similar to that which produces dropsy in other structures, perhaps deficient absorption, or, more probably, increased secretion, the result of inflammation. In some cases, little if any liquid has been contained in the sac, and but little inconvenience been experienced; but when once it has begun to accumulate, the irritation caused by its presence induces its continuance, and in some instances augments it.

PATHOLOGY OF SPINA BIFIDA.

On this subject I propose to dwell at considerable length, since it involves many interesting and important points, and shall in the following observations take into consideration, *first*, the envelopes of the tumor; *secondly*, the state of the vertebræ; *thirdly*, the condition of the spinal cord and its membranes; *fourthly*, the situation of the spinal fluid; and *lastly*, the chemical nature of the contents of the tumor.

I have already remarked that the colour of the integuments varies according to the contents of the tumor: they may be reddish or striated, smooth or rough, and permeable to strong light, or otherwise: they are often much distended, and sometimes so dense as not to subside on an opening being made into the sac; hairs are said in some cases to have surrounded the tumor. Its general envelopes have not always the same anatomical structure: in some cases they are formed of the skin, dura mater, and arachnoid; in others of skin and dura mater, the fluid being exterior to the arachnoid; sometimes, again, the skin is entirely wanting, and the dura

mater is the external covering. This, Camper* thought, was always the case, but it is doubtful whether it occurs so often as his description would make us suppose. I suspect that in some of the cases which came under his notice the coverings were so thin from distension as to mislead him by their extreme transparency, or some of them may have been destroyed in course of time by the pressure of the subjacent structures. In those cases where the skin is present, it is found to adhere closely to the dura mater.

The spinal column may be affected in Spina Bifida either generally or partially, and in the latter form of the disease authors are agreed in stating that it is much more common in the lumbar region than in any other part. Some authors, indeed, have gone so far as to explain in express terms the cause of its more frequent occurrence in that situation. Busser,† for example, supposes that it arises from the dura mater being more lax, and its union with the apparatus of the vertebræ less firm in this than in other parts of the column. Again, the peculiarities of the ligamentum denticulatum, the softness of the intervertebral cartilages, and the greater distance from each spinous process in the lumbar region, have each been

* Camper, Dessert. de Hydrope.

† Busser, de Hydrope, 1798.

accused as the immediate cause of Spina Bifida in that region. Next in frequency is the dorsal region, and the occurrence of Spina Bifida is here comparatively very rare, which is easily accounted for, from the fact that the spinous processes of the dorsal vertebræ are formed long previously to those of the lumbar,—the former having been seen perfectly ossified, when there was merely a membranous band extended between the latter. It is evident from this, that if a tumor is to present, from whatever cause it may arise, it will do so at the weakest point of the column, which is the lumbar region. The occurrence of Spina Bifida in the cervical and sacral regions is extremely rare. One case of the latter is mentioned by Paletta* in a lad seventeen years of age. With respect to the coccygeal Spina Bifida, I am somewhat sceptical that such a case can exist, although mention has been made of it by some authors of character. It is possible that such may occur in *Complete* Spina Bifida, but it is not of this that I am speaking at present. Fleischmann has spoken of the state of the vertebræ in this disease as divisible into three classes. In the first class "the rudiments of the vertebræ are present, but its two lateral arches are ununited." This is a rare form of the parts,—the separation being to the extent of a few lines only, as

* Paletta, Exercital. Patholog. Mod.

Ruysch * remarks, so that a very small aperture results. Ruysch mentions having seen one case of this description in the lumbar region, and a second is mentioned by Acrell† as occurring in the sacrum.

In the second class " the two lateral arches are imperfectly developed," and this is by far the most common of the three. The spinous processes alone may be absent, or the laminæ also. Indeed the imperfection may be so great as to present nothing but the body of the vertebræ. The varieties of the second division are numerous. Sometimes the arches are wanting on one side, at others on both; sometimes this defect is general, at others it is confined to one or two vertebræ; and when one only is defective, the tumor is pyriform and pedunculated.

In the third class " the body of the vertebræ is divided into two parts,"—an example of the sudden cessation of developement, constituting the rarest form of this disease. Tulp's case must come under this head, in which the spine was divided into two lateral portions, from the last dorsal vertebræ to the sides of the ossa innominata, the peritoneum being observed stretching across the fissure. Wepfer‡ also mentions a case in which the whole of the dorsal

* Ruysch, Obss. Anatom. Chirurg.

† Acrell, Ibid.

‡ Andral, tom. ii.

portion of the spinal column was divided in such a manner as to permit the kidneys and other viscera to be seen. Budgen * likewise relates a case in a girl eighteen years old, in whom the spinal canal communicated with the abdomen.

Spina Bifida has, however, occurred independently of any failure in the organization of the spine, merely from the processes being smaller than natural, or from their not forming so complete a canal as they generally do. This has been observed by Portal,† at the junction of the last lumbar vertebræ and the sacrum; but it is extremely rare, and ought not to be considered as an argument in favour of the doctrine, that the tumors and opening in the column are caused by the pressure of the fluid from the brain.

I come now to the third division of this branch of my subject, viz. the state of the spinal cord, and its envelopes. In some cases the spinal cord has been found perfectly natural; in others, the alterations of structure and position have been numerous, while in some instances it has even been wanting. I propose considering it under the three heads of changes of structure and position, and of deficiency. The affection of the cord sometimes ex-

* Philosophical Transactions.

† Portal, Cours d'Annal. Med.

tends beyond the fissure in the vertebral column, as was observed by Ruysch; but cases are recorded in which it has been of its natural structure, after suffering slightly opposite the cleft. It is occasionally longer or shorter than in its normal state, and sometimes there is a fissure extending throughout its whole length, forming a distinct canal, which communicates with the ventricles of the brain, as has been observed by Portal and others in infants, and as always occurs during the early months of fœtal developement. Sometimes again it is laid out in the form of a dilated membrane, with small points of softening or ulceration; or it may be in general so soft as to resemble nearly a fluid mass. Ruysch and Greene* further mention having seen it covered with vesicles resembling hydatids. When it has been the seat of inflammation, as after ulceration of the tumor, it is found remarkably injected with red vessels. This appearance is of course increased by the pia mater having partaken of the inflammation. As to the position of the spinal cord, although generally situated in the vertebral canal, it sometimes either terminates in the tumor, or sends a prolongation into it; and to such an extent sometimes is this irregular distribution, that in one case seen by Burgius, the inner

* Olivier, Ibid.

portion of the sac resembled closely one of the ventricles of the heart,—so numerous were the nervous expansions. A similar appearance has also been seen by Apinus,* but in a minor degree. More generally, however, when the spinal cord is contained in the sac, it consists merely of a small portion, which runs for a short distance along the superior aspect of the tumor. The spinal cord, lastly, may continue in its proper situation, but give off nerves to the tumor.

With respect to the deficiency of the spinal cord, some authors, and particularly Schrœder, Ruysch, and Morgagni, have stated that it has been entirely absent; but this, as Camper and Moeckel† conclude, may have arisen either from its softening and getting into a semifluid state, or from its having been actually wanting, in consequence of congenital malformation. With this reputed deficiency of the spinal cord it has been alleged that the child possessed some power over its limbs; but this appears to be the very best argument that the spinal cord was not absent, but merely in the state in which we find the hydrocephalic brain. The spinal membranes are seldom much altered in structure in this disease, but they occasionally present appearances of inflam-

* Apinus, Hochtetter de Spina Bifida, 1703.

† Moeckel de Hydrorhachitide.

mation, such as increased vascularity, lymphy deposit, and general thickening.

The fluid in Spina Bifida may occupy various situations; but previously to considering this part of our subject, it may be proper to make a few remarks on its normal situation. It has been allowed by most anatomists that a fluid of a serous nature lubricates the membranes of the cerebro-spinal system; but that this serosity existed in any appreciable quantity they were not aware, until the observations of M. Magendie in 1825 and 1827.* This physiologist has endeavoured to shew that what was in former times considered an anormal and morbid state of the parts, is perfectly natural, and unconnected with disease; and that a fluid naturally exists in the cranium and spine, varying in quantity from two ounces to nearly five. This he determined by experiments upon dogs, and observations after death on the human subject, where no disease had previously existed. He removed the posterior parietes of the vertebral canal in a vigorous dog, when fluctuation and evident distension were observed beneath the membranes which were exposed,—so much so, that when these were opened in the living animal a jet of fluid was projected to the distance of some inches. This fluid is situated throughout all the vertebral canal and

* Magendie, Journal de Physiologie.

cranium, but is in greatest abundance at the lumbar region; and it is from this circumstance, according to M. Magendie, that Spina Bifida is of more frequent occurrence here than in any other part; but without questioning the fact of the greater quantity of fluid in this part, I trust I have shewn that the more frequent occurrence of Spina Bifida in the lumbar region can be accounted for on different and more scientific principles. This secretion is removed in a very short period after death, so that it may, and does often escape the observation of the anatomist, not only from this circumstance, but also from its being mixed with blood effused during the necessary dissection. M. Magendie thus accounts for the void space which exists between the brain and cranium on the removal of this fluid, which is supposed to be of service in lessening the shock which the nervous system receives either during stooping or from external causes.

The immediate seat of this serosity has been a matter of speculation. The general opinion is, that it is secreted by the arachnoid membrane, which is similar both in structure and function to other serous membranes, but in this opinion M. Magendie is not inclined to coincide. He supposes that it exists between the pia mater and the surface of the arachnoid, covering that membrane; and in corroboration of this opinion he states that when the dura mater, lined as it is

by the arachnoid, is opened gently, no fluid escapes, but that on carrying the incision a little deeper, a fluid immediately flows out. It must be confessed that the arguments he uses are tolerably strong, but still I am inclined to agree with the general opinion, that its proper situation is within the sac of the arachnoid; and indeed I do not see how otherwise the arachnoid can be said to correspond in function with the serous membranes in general.

With respect to the seat of the fluid in Spina Bifida, it is said to have been met with in a canal in the centre of the spinal cord, according to Brunner, Senac, Moeckel, and some others; between the pia mater and arachnoid; in the sac of the arachnoid, and this I believe to be its most common seat; between the arachnoid and the dura mater; between the membranes of the spinal cord and the osseous parietes of the spinal canal; and in a distinct cyst, leaving all the membranes unaffected.

Olivier supposes that in the case where the vertebral canal is cleft completely, the serosity is contained in the central canal of the spinal cord, but that from the distension of the pia mater this membrane may be ruptured, and thus change the situation of the fluid. Its quantity varies considerably, but it is difficult to estimate it exactly: it has been calculated from a few ounces to a pint or two.

In its nature the fluid in Spina Bifida is generally

analogous to other serous fluids, particularly that in hydrocephalus. It is sometimes of a straw colour, at others bloody or purulent,—the latter appearance occurring after ulceration of the tumor, or unsuccessful puncture. Occasionally it has the odour of urine, and is of a saline taste. Bostock and Marcet have made accurate analyses of the fluid when of its ordinary quality, of which the following is the result:—

BOSTOCK.*

Water,	97.8
Hydro-chlorate of soda,	1.0
Albumen,	0.5
Mucus,	0.5
Gelatin,	0.2

Traces of Lime.

MARCET. †

Water,	988.60
Animal matter, muco-extractive, with a little albumen,	2.20
Hydro-chlorate of soda,	7.65
Soda brought to a state of a subcarbonate, with traces of an alk. sulph.,	1.35
Phosphate of iron and lime,	0.20

* Bostock, Edin. Med. and Surg. Journal, vol. ii, 1806.

† Marcet, Med. Chir. Transactions.

From these analyses it appears that the fluid of Spina Bifida bears a closer resemblance to that of hydrocephalus than to any other serous fluid, since it contains much less albumen than these do, while it almost corresponds in this respect with that secreted in the brain.

Before proceeding to the treatment of Spina Bifida, it is proper to say a few words on the second great division of our subject, viz. *Complete Spina Bifida*, or that form of the disease which depends on an incomplete ossification of the posterior parietes of the spinal column throughout its whole extent. Fleischmann observed a remarkable case of this in which the fissure extended from the first cervical vertebra to the sacrum, and was narrower in the lumbar region than in the dorsal. Cases also of *Complete Spina Bifida* are given by Paletta, Morgagni, and some others. It may be easily supposed that this is a form which seldom comes under the notice of the medical man ; and as the observations already made upon Incomplete Spina Bifida bear more or less directly on this, it is unnecessary to dwell particularly on the subject.

ON THE TREATMENT OF SPINA BIFIDA.

Spina Bifida is perhaps one of the most fatal diseases to which man is subject, the patient seldom surviving to the third year, and being most frequently cut off within a few hours after birth, in consequence of inflammation of the tumor and spinal marrow, resulting from pressure during delivery. Cases are however on record, on the authority of well known writers, of spontaneous cures of Spina Bifida; but perhaps in most of these the tumors, like those described by M. Boden,* did not communicate with the spinal column, but were merely morbid growths from the vertebral region. Nevertheless Morgagni relates at considerable length two cases of spontaneous cure of true Spina Bifida. One in a twin, aged twelve years, which lived till its twenty-eighth year. Nor are other examples wanting of what may be considered remarkable longevity amongst persons affected with Spina Bifida. Acrell and Paletta make mention of a patient who lived to his seventeenth year; Jukes† of another who reached his nineteenth; and Warner ‡

* Moeckel, Ibid.

† Jukes, London Medical and Physical Journal, 1822

‡ Observations on Surgery, 1784.

and Apinus speak of cases which survived to the twentieth year, during which period Warner states the individual suffered very little except from paralysis of his lower extremities. But of all such cases, that related by Schwaagermann * of the patient with Spina Bifida who lived to the age of fifty, is certainly the most remarkable.

So irremediable was Spina Bifida considered in former times, that physicians hesitated to employ any means for its alleviation, and never attempted its removal; and even some modern authors disapprove in strong terms of using any treatment whatever, particularly M. Itard, † who says that it ought to be a matter of consideration whether it is advisable to take means to prevent the bursting of the tumor, by which we only prolong for a few days or weeks a state of vegetative existence in a being that is not viable; and certainly several points of prognosis are worthy of consideration before deciding upon any treatment whatever. *First*, Whether it be *Complete* or *Incomplete* Spina Bifida; and if belonging to the latter division, what are its extent and situation? *Second*, Whether it belong to the first, second, or third class of Fleischmann?

* Schwaagermann, Ontleed-heelkund. Verhandl. Amstel. 1767.

† Dictionnaire des Sciences Médicales, vol. xxii.

Third, What are the nature and state of its envelopes? *Fourth*, Whether it be combined or not with hydrocephalus? and *lastly*, Whether the general health be good, and what degree, if any, of paralysis is present? All these matters should be well revolved by the medical man before proposing any line of treatment, whether *palliative* or *radical*; but it is probable that there are but very few cases which could be injured by the former.

I shall speak of the treatment of Spina Bifida under the two heads just alluded to—the *Palliative*, and the *Radical*.

The former consists in preventing the extension of the tumor, and in guarding it against injury. To effect these objects, slightly astringent lotions, and mild plasters, with well adapted bandages, are the means best suited; and of course lying on the back must be prohibited, and all friction from the clothes prevented. Irritating plasters or ointments are to be avoided, lest they should produce ulceration, and an opening into the tumor. Internal medicines are of little or no avail.

The *radical* cure of Spina Bifida is that which has for its object the removal of the tumor, in whatever way this may be effected.

The attempt to bring about absorption of the

fluid contents of the tumor by *compression*, and thus to remove what may be considered an impediment to the union of the vertebræ, was revived a short time ago by Sir Astley Cooper,* for we are informed that previously to the time of that great surgeon, such a plan of treatment was sometimes employed. With the view of effecting more complete pressure, a thin plate of lead has been proposed to be placed under the bandage, but I should feel some hesitation in employing this, lest it should create too much irritation of the walls of the tumor. Heister † mentions a case cured by this mode of treatment, and Sir A. Cooper relates another in which, a truss being constantly worn, the child did well, but it could not be removed, as the tumor always presented on this being done, from which it is obvious that in most cases the truss merely compensates for the absence of the bony parietes.

The introduction of a "seton" has been proposed as a curative measure by M. Desault; ‡ but the practice does not appear to be advisable. The object is to permit the fluid to escape drop by drop, while at the sametime the entrance of air is prevented, and, by promoting adhesion of the neck of

* Med. Chir. Transactions, vol. ii.

† Heister, Chirurg. Wahrenhm.

‡ Desault, Traite des Malad. Chirurg. 1779.

the sac, to prevent the fluid from again making its way from the spinal cord into the tumor. That the second of these objects can be attained is very questionable, for any accidental shifting of the dressing from the wound would permit air to enter; but perhaps this is not a very serious impediment to the employment of the seton. A more serious objection appears to be, the probability of passing the seton through the spinal cord in its course through the tumor, which would produce inflammation, and that of important structures, and death would speedily result. A case corroborative of this is given by Fleischmann: the child died the day following the introduction of the seton by the surgeon.

The mode of treatment proposed by Richter* requires little comment. That surgeon imagines that by the operation of a seton at a little distance on each side of the tumor the fluid might be absorbed, and a cure thus effected; but it is evident from the remarks which have been made on the pathology of Spina Bifida, that the presence of the fluid may, and frequently does, arise from hydrorachis; and that although the accumulation might be diminished, it could not be altogether removed by this means,—to say nothing of its total inefficacy in repairing the fissure in the vertebral column.

* Richter, Anfangsgr. der Wundarzn.

Mr. Benjamin Bell * was the first to recommend the "ligature," with which he proposed surrounding the base of the tumor, for the purpose of producing sloughing and subsequent adhesion of the neck of its sac. This plan, however, as far as I know, he never put in practice; but whether he relinquished it in consequence of the very severe symptoms generally said to follow the application of the ligature, or from the want of a case to try it on, we are not informed. But although this method of attempting a radical cure of Spina Bifida is generally deprecated, and particularly by the author of that article in the Encyclopédie Méthodique, and the author of the Surgical Dictionary, it does not appear to be quite unworthy of the attention of the surgeon. I am induced to make this remark in consequence of cases and observations inserted in the Boston Medical and Surgical Journal, an abstract of which is given in the Journal de Progrès des Sciences et Institutions Médicales for 1829, vol. xvii. The cases I refer to were under the charge of Dr. Frowbridge of Watertown, state of New York. In the first case which he relates, the child was healthy, and possessed full power over its lower extremities. He surrounded the neck of the tumor, which was situated on the cervical region, with a

* Bell's System of Surgery.

fine silver wire passed through a small cannula, moderately tightening it at first, and forty-eight hours afterwards increasing the tension, so as to interrupt all circulation through it. Twelve hours after this, slight fever and constitutional irritation supervened, accompanied with sloughing of the tumor, and slight suppuration around the ligature, upon which he removed the tumor with a knife on the distal side of the wire, when a serous fluid flowed from the wound. This continued for sometime, but cicatrization ultimately took place, and the child enjoyed good health. An opening was observed between the two last cervical vertebræ.

In a second case, where the ligature was employed, the tumor was situated on the three inferior cervical vertebræ, with a base four or five inches in circumference: it was nearly seven inches in its longest diameter, and about four inches from its base to the apex. From its bulk, it often created much uneasiness, and the child had paralysis of its thumb and index finger. The operation was performed in a similar way, only permitting the ligature to remain longer on, in consequence of the broad base of the tumor; and it was followed in a few weeks by the same happy results,—the paralytic affection of the hand also disappearing. Dr. Frowbridge considers that those cases in which the fluid is ex-

ternal to the arachnoid are best adapted for the employment of the ligature.

It becomes a question, however, whether we are to consider these as cases of Spina Bifida, or merely encysted tumors? Certain it is that one great symptom of this disease was present, viz. the fissure in the vertebral column; but we regret exceedingly that Dr. Frowbridge has not favoured the profession with a description of the contents of the tumors after removal, as such a description would have set at rest every doubt on this subject. At all events, the cases are well worthy of attention.

"Puncturing" the tumor was first put in practice by Hoffman* in 1685, and with success: it was, however, till lately, a mode of treatment seldom attempted, and was much decried by Tulp and others, from the fatal symptoms which almost always attended it,—the case just mentioned, and another by Camper, being perhaps the only two successful instances of it till the operation was revived by Sir Astley Cooper.† The object is, by evacuating the fluid, to produce adhesion of the sac, so as to close the opening from the spine, and thus repair, as it were, the breach in the vertebral canal. From the remarks which Mr. Abernethy‡ makes at the ter-

* Moeckel, Ibid. † Med. Chir. Tranactions, vol. ii.

‡ Abernethy's Surgical Essays.

mination of his papers on Lumbar Abscess, it is evident he was not aware of the puncture having been put in practice in Spina Bifida previously to the time he wrote; for he there suggests that the treatment which he employs in lumbar abscess might perhaps be of service in this disease. He mentions indeed having tried this treatment, but the case was one by no means favourable for the experiment, as ulceration had already commenced in the tumor, and the discharge becoming purulent, the child died.

Sir A. Cooper employed puncture with success in a child ten weeks old, still retaining the power over its lower extremities, and in every respect a fit subject for the trial of this plan. The details of the treatment are similar to those which are related in Mr. Abernethy's case. He attempted the treatment in another case, but convulsions supervened, and the child died. The result of the cases given to the world by these two eminent surgeons showed that the suddenly fatal result described by authors did not necessarily follow the evacuating the fluid from the tumor; and in consequence of Sir A. Cooper's success, this plan has been employed by several surgeons. Among others, Probart of Hawarden* employed the puncture in a child three months old:

* Journal des Progrès des Sciences et Institutions Médicales, vol. vii.

inflammation came on, which being soon subdued, a bandage was applied, and the tumor gradually diminished, and ultimately disappeared, leaving merely a depression. There is mention also in the same journal for 1827 of two cases of Spina Bifida successfully treated on the same plan.

I am enabled, through the kindness of Professor Turner, to add two cases of Spina Bifida treated by puncture, which occurred in the practice of Mr. Young of this College, and which were seen by Professors Thomson and Turner. As I consider them not only interesting, but extremely important, I subjoin the report as drawn up by Mr. Young.

11th April 1814.—Mr. Young was called to a case of Spina Bifida a few minutes after the child was born. An elastic transparent tumor, about the size of a large orange, was seated on the lumbar vertebræ, near the top of the sacrum. The tumor measured six inches round its base, and nine inches round the largest circumference. The integuments over its apex were very thin, and of a livid colour, but were thicker and of more natural appearance near the base. The infant was small and weakly, moved its legs freely, and the head was of the natural size. Neither stupor nor convulsions were induced by pressure on the tumor.

April 12.—The dangerous nature of the case was explained to the friends, and Professor Thomson was consulted. By this time small vesications had formed upon the livid part of the tumor. Dr. Thomson proposed the treatment recommended by Sir Astley Cooper.

Accordingly the tumor was punctured with a couching needle near its base, and the greatest part of the contained fluid drawn off. The integuments of the sac being tender, a piece of lint, wet with the solution of the acetate of lead, and a bandage, were applied.

April 14.—The whole fluid was discharged at this time, making in all about $3\frac{1}{2}$ ounces by measure, since the 12th. The pressure used to evacuate the fluid excited involuntary discharges from the rectum and bladder.

April 27.—Vesications on the top of the tumor healed. A compress of lint has been applied over it, and retained by adhesive straps.

May 4.—The integuments of the sac being very vascular, the wound made at this time by the needle caused the effusion of blood within, and the coagula interrupted the stream of serous fluid; this interruption was obviated by pushing back the coagulated blood by a small probe. The mother is feverish, and the child reported to have had a fit yesterday morning; stools frequent and green.

May 9.—Has had two doses of jalap with calomel; stools natural.

The tumor is considerably diminished; the skin over it much thickened and corrugated. The sac, after each puncture, was folded, drawn to one side, and retained by adhesive straps.

May 19.—When the fluid is drawn off, an opening can be felt in the vertebral canal, sufficient to admit the point of the finger, from which arises a substance about the size of a goose quill, which appears to be attached to the internal surface of the sac.

June 30.—Made two punctures at this time.

July 2.—A compress of sheet-lead and cork was now applied over the opening in the vertebræ, and retained as formerly.

July 19.—The child's general health and appearance much improved, although she has had severe fits of crying, and frequent green slimy stools; relieved by doses of carbonate of magnesia.

July 23.—Punctured in three places at this time. The punctures have never been made in the same place, although sometimes pretty near each other; and that part of the tumor was punctured where the skin was thickest and most vascular, expecting in this way to excite the adhesive inflammation more readily.

July 28.—There ~~was~~ ere at this time no involuntary evacuations, although considerable pressure was made to force out the fluid; the parietes of the sac may be about the thickness of the skin of an orange. About this time the patient left Edinburgh. Forty-five ounces and two drachms of fluid have been evacuated between the 12th April and 28th July 1814, by thirty-seven punctures or operations. The dates of the operations and quantity of fluid evacuated each time are marked in the following table, to shew the alternate increase and decrease of the secretion, —having carefully collected the fluid in a graduated glass measure at each operation.

1814.	Fluid discharged. oz.	drs.		Fluid discharged. oz.	drs.		Fluid discharged. oz.	drs.
April	14. 3	4	May	17. 1	0	June	25. 0	10
	15. 1	0		20. 1	0		27. 0	10
	18. 2	0		24. 0	10		30. 1	4
	20. 0	4		28. 1	4	July	2. 1	0
	23. 1	4		31. 1	0		6. 0	10
	27. 2	0	June	3. 1	0		8. 0	10
	30. 1	4		5. 1	0		11. 0	11
May	4. 1	6		9. 0	10		16. 1	4
	6. 0	6		12. 0	10		19. 1	1
	9. 0	4		15. 1	4		23. 1	4
	11. 0	4		19. 0	10		28. 1	4
	14. 0	6		22. 1	4			
							45	2

September 31, 1816.—The mother called upon Mr. Young with the child, and stated that she had been in London, and applied for advice at some of the hospitals there. The child creeps through the house; cannot walk, but can stand with a lean against a chair. The tumor at this time was hard; the cavity of it appeared to be completely obliterated; measured five inches and a half round the base, and six inches round the middle; three inches long in the course of the lumbar vertebræ, and two inches and a half from side to side.

January 30, 1817.—Mr. Young saw the child at this time with Mr. Lizars, who obtained a cast of the tumor. The child has involuntary evacuations, supposed to be owing to the weight of the clothes pressing on the tumour on the sacral nerves, or it might be an effect of teething. It was proposed to have a shield fitted so as to keep off the pressure of the clothes. Mr. Young had no opportunity of seeing the case after this, and was lately informed by the midwife who attended, that the child died sometime in the summer of 1821, being then aged about seven years.

July 9, 1814.—Mr. Young was called to visit a child in the Canongate within twenty-four hours after it was born. An elastic transparent tumor of

a pyramidal form, about the size of a large walnut, was seated on the lower lumbar vertebræ. The child had been born before the midwife arrived, while the mother was crossing the apartment to her bed. The umbilical cord was broken by the fall, and a small portion of the cuticle rubbed off the top of the tumor. There was the appearance of a watery vesicle having been formed on the surface of the tumor before the accident. The legs were contracted, and the toes turned upwards ; but there was nothing remarkable in the appearance of the head. A piece of lint dipped in solution of the acetate of lead was applied, with a bandage.

July 11.—Punctured the tumor with a couching needle. Three drachms of serous fluid were evacuated, but a little remained, as the tender state of the integuments would not admit of sufficient pressure to discharge the whole.

July 15.—Professor Thomson and Mr. Turner visited with me at this time ; the integuments a little thickened ; pressure on the tumor excited evacuations from the rectum and bladder.

August 6.—Half an ounce of bloody fluid evacuated ; the integuments of the sac much thicker, and vascular ; not having the couching needle with me, I used a lancet ; the wound was larger, and it

bled more than usual, so that I had to push back the clots with a probe.

August 8.—The fluid at this time was thickish—a compress of lint, wet with the solution, was applied with adhesive straps.

August 10.—Less appearance of vascularity, and the discharge thick and ropy.

August 13.—The discharge had become so thick and tenacious at this time, that it was necessary to enlarge the puncture with a lancet, before it could be evacuated.

August 15.—The matter discharged at this time was yellowish.

August 25.—Although the tumor felt soft and elastic, there was no discharge at this operation. The tumor afterwards became flattened, and the central part of it was drawn inwards. Adhesive straps were applied over it, and a roller round the abdomen. The sac having united firmly to the spine, the straps and bandage were laid aside. The child was now about seven weeks old, and I considered the cure effected by the adhesive inflammation. The child, however, died 28th October, in consequence of bad nursing. The period of the operations and fluid discharged are the following ;—

1814.	Fluid evacuated. oz.	drs.		Fluid evacuated. oz.	drs.		Fluid evacuated. oz.	drs.
July 11.	0	3	July 25.	0	4	Aug. 10.	0	4
14.	0	3	28.	0	2	13.	0	4
15.	0	2	30.	0	2	15.	0	4
16.	0	3	Aug. 2.	0	4	19.	0	2
18.	0	2	6.	0	4	25.	0	0
20.	0	1½	8.	0	4			
							6	0½

Appearances on dissection, at which Dr. Gordon and Mr. Turner were present.

The sac was lined by a solid pinkish coloured mass, which adhered firmly to the internal surface of the sheath of the spinal cord, and to the contained nerves. The nerves were traced passing through the foramina of the sacrum, and between the lumbar vertebræ: But in the tumor they were massed with the new-formed substance, and their appearance and texture so much altered, that it was not easy to trace them into the spinal cord. The spinal cord, immediately above the tumor, appeared quite sound and natural in structure.

The spinous plates of the two last lumbar vertebræ and the whole of the spinous plate of the sacrum were wanting.

There was no more water in the ventricles of the brain than what is usually found after death. Considerable rigidity of the flexor muscles of the legs,

and of the extensors of the feet; but no deformity of articulation at the knees or ankles. These two cases may be considered as striking instances of the happy result of the treatment by puncture.

Mr. Okes* objects strongly to this mode of treatment; but his objections are by no means tenable. He states that unless the dura mater contracts, no cure can take place; but it is not absolutely necessary that this membrane should contract; all that is required is, that a sufficient degree of inflammation be caused in the base of the tumor, to produce adhesion; and as to his doubts whether an opening in the dura mater would heal, no good reason can be assigned why this membrane should not be as capable of union as any other fibrous tissue.

Sir A. Cooper gives a set of forms of the disease which are not susceptible of cure by puncture. 1. When there is enlargement of the head from hydrocephalus. 2. Where there is paralysis of the lower extremities, with incontinence of urine and fæces. 3. When the tumor has received injury at the time of birth; and 4. When the deficiency of the spine is so extensive as to implicate the nerves.

These objections it is proper to keep in remembrance; but it is questionable whether the last can be always ascertained before the operation.

A plan of treatment which I have seen adopted

* Okes' Account of Spina Bifida, 1810.

in one instance with success, is that of removing the tumor by "excision" through its base. This practice appears to have originated with Brunner; * but in his case it was unsuccessful. It is evident that cases permitting of this are of a peculiar nature; but before I enter more fully into this subject, I will subjoin an account of the case in which I saw it employed, with a description of the tumor.

My father, on the 13th August 1832, was requested by his friend Professor Hamilton to visit a child in Stockbridge, which was born on the 10th under the care of Mr. Crighton of that place.

There was a tumor situated in the lumbar region, of a pyriform shape, and attached by a narrow pedicle to the space between the third and fourth lumbar vertebræ, to the right side of the spinous processes, where a fissure could be felt. It was translucent and fluctuating, and about the size of a small orange. It could not be diminished by pressure; nor by this was there any comatose effect produced: the child, however, evinced pain and uneasiness when the tumor was handled. The limbs were perfectly sensible, and the urine and fæces were under the control of the will. On the 14th the tumor was somewhat less tense, and displayed several points of discoloration. It was deemed pro-

* Moeckel, Ibid.

per that it should be removed, which was accordingly done by two elliptical incisions made on each side of its base or neck, when a fluid of a straw colour immediately escaped from the sac. After subduing the bleeding, which was slight, the wound was brought together by a small piece of adhesive plaster, and a pledget and bandage were applied. The child suffered little after the pain of the operation had subsided; there was no symptom of paralysis, and it took the breast freely. The dressings were removed two days afterwards, when adhesion was found to have taken place in several points of the wound. The same treatment was pursued, and in a few days the wound was completely healed, and the child continued perfectly well.

On dissecting the tumor it was found to contain the dura mater closely attached to the integuments with the arachnoid membrane, and a portion of nervous substance, which, after passing into the sac as a single cord, immediately divided into several minute fibrillæ. At the superior portion of the tumor also a small soft tubercle of the size of a pea was observed. The fluid coagulated slightly on exposure to heat.

As I was somewhat sceptical as to the presence of nervous matter, I showed the tumor to Dr. Knox, who removed all doubts upon the subject, by stating it as his opinion that the tumor had the character of

one of Spina Bifida, and that the substance contained in it was of nervous structure. The tumor was afterwards shown to Professor Turner, who coincided in this opinion.

From the detail of the symptoms of this case it appears that although there was an obvious fissure in the vertebræ, still, by the progress of developement the tumor had become excluded from the vertebral canal, and had an independent existence. It was therefore extremely well adapted for the employment of the practice which was pursued, or for the puncture; but probably the excision was preferable, as the flap of skin after the fluid had been removed would have been much exposed to irritation. It is a plan certainly the most formidable of those I have mentioned, and is indicated only in cases similar to the one in which it was here resorted to. *

* Since writing the above I have been informed by Mr. Crighton that the child continued well in every respect until it was about seven months old, when it died of hydrocephalus, after an illness of three weeks. Mr. Crighton examined the seat of the disease in the spine, and made minute notes of the morbid appearances. These, however, were accidentally destroyed, so that he is unable to furnish me with all the particulars, but has obligingly favoured me with the following :—The skin exhibited only a small cicatrix slightly retracted, where the tumor had been situated. On removing the muscles and other structures around the spinal column, the third lumbar vertebra was absent, its place being occupied by a strong ligamentous band.

I shall conclude my remarks upon the treatment of Spina Bifida by stating that it must, of course, vary according to circumstances, and that in general the *palliative* treatment will be resorted to, although, from the cases which have been mentioned, the *radical* method of cure may be adopted with some prospect of success.

In a disease so rare as this is, and which so seldom falls under the observation of the surgeon, it was not to be expected that I should be able to offer any thing new; and I shall have fully attained my object if I have succeeded in laying before the College an accurate account of a disease, at once so interesting and so little noticed by British surgeons.

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