ON
WOUNDS OF THE THECA VERTEBRALIS
WITH
DISCHARGE OF CEREBRO-SPINAL FLUID.

BY
TIMOTHY HOLMES, F.R.C.S.,
SURGEON TO ST. GEORGE'S HOSPITAL.

(Received March 6th—Read April 25th, 1882.)

IN a communication to the Society, published in the sixtieth volume of the 'Transactions,' I related the case of a boy, æt. 13, who received a stab in the loins, and whose case presented the peculiarity of a copious discharge of watery fluid from the wound. This fluid must have been either urine from the ureter or cerebro-spinal fluid, and it was difficult to decide which. I argued in that paper that it was probably from the ureter, and I proved, by experiment on the dead subject, the ease with which the ureter could be reached by a stab wound in that situation. The enormous quantity, and the copious and continuous flow of the fluid, were also features in the case which were difficult of explanation on the hypothesis that the fluid was cerebro-spinal; while, on the other

hand, its composition was at least very similar to that fluid, and no urinous constituents could be clearly recognised in it by chemical examination.

I will now proceed to relate an undoubted case of wound of the spinal theca which occurred recently under the care of my colleague, Mr. Rouse, at St. George's Hospital, and will then subjoin notes of a similar case which was published a few years ago in one of the journals, and which proved fatal, and was examined after death.

For permission to use the notes of the subjoined case (which were taken by Mr. Fuller, the house surgeon) I am indebted to Mr. Rouse.

William W—, a schoolboy, æt. 11½, was admitted under Mr. Rouse's care suffering from a small punctured wound of the back June 25th, 1881.

History.—On June 19th he was stabbed by another boy whilst at play with a penknife having a blade about one inch and three quarters in length. There was trivial bleeding at the time of the accident, but shortly after he was taken home it was noticed that "watery stuff" ran from the wound.

The flow ceased on June 22nd, the wound having scabbed over. On the evening of June 24th the patient rubbed off the scab, the "watery flow" recommenced, and continued till the time of admission.

Between June 19th and June 25th he was under medical treatment at home. He was kept in the prone position, and water dressing applied to the wound.

On admission (June 25th).—A pale, delicate-looking lad. No head symptoms of any kind. No spinal symptoms. No loss of muscular power or sensation. Gluteal reflex and spermatic reflex unimpaired. Trousseau's *tâche cerebrale* easily elicited. Bowels open and acting regularly. Urine passed easily; reaction acid; characters normal.

N.B.—The boy was carried into hospital in the prone position. He refused to stand up, and his friends evidently wished him not to attempt to do so; and the point was not

pressed. A careful examination in bed showed this was not due to loss of muscular power.

A wound exists in the small of the back. Draw a line round the body on a level with the highest point of the crests of the ilia, one inch and a half below this line, and a quarter of an inch to the right of the median line, is a small vertical wound just a quarter of an inch long.

There is no redness around the wound, and no tenderness. Pressure about the wound caused no fluid to exude, but, on making the patient wriggle about, a copious flow of limpid, colourless fluid takes place, so that in half an hour almost a test tube full was collected.

A piece of plaster was placed over the wound, the whole sealed with collodion. Prone position maintained.

26th.—Slept well. Tongue clear. Appetite good. Fluid having escaped under the collodion, the house surgeon drew the edges of the wound together with two fine silk sutures; over this a minute piece of lint was placed, over this plaster, and the whole sealed with collodion.

29th.—No further escape of fluid. Prone position maintained.

July 3rd.—Slight irritation from collodion. Prone position maintained. Health excellent.

9th.—Lint and collodion came off. Wound healed; slight bulging at seat of wound; sutures removed.

14th.—Bulging increased since last note. Dressed yesterday and walked about ward: no symptoms have resulted.

24th.—Boy, kept till now for observation, is perfectly well. All movements natural; sensation perfect. A simple scar remains. Discharged.

October 25th.—Seen by house surgeon at 5 U, Peabody Avenue, Pimlico. A small, slightly depressed, pink cicatrix, the size of a barley-corn, remains. Boy seems in perfect health though looking delicate. All movements natural.

Characters of fluid.—Clear, watery, saline to taste, re-

action alkaline; a very faint trace of albumen (?). Argentic nitrate throws down a white precipitate.

Mr. Donkin reports on the fluid that it has a "specific gravity 1.008, and contains altogether 1.12 per cent. of solid matter dissolved and suspended. Of this 0.22 is organic, the residue blackening on heating and burning partially away, leaving 0.9 per cent of inorganic salts. These consist chiefly of chloride of sodium and carbonate of sodium in about equal proportions (the latter no doubt formed, partially at least, on incineration), with traces of phosphates. The original fluid does not change (apparently) on heating, and does not reduce Fehling's solution."

The fluid above described was collected between 4.30 and 5 p.m., June 25th. No doubt some of the organic material above mentioned was due to the test-tube scraping off epithelial scales whilst the fluid was being collected. A few epithelial cells were found under the microscope.

The only case I have found of punctured wound of the spinal membranes in which a dissection was obtained, is recorded in the 'Lancet,' vol. ii, 1876, p. 457, by Surgeon-Major Gribbon. The patient, a man æt. 32, stabbed himself in the back of the neck in a fit of insanity, and died nineteen days afterwards. The wound, which opened the spinal theca, was inflicted with a penknife. It was $\frac{3}{4}$ inch in length, and a probe passed down it impinged on the arch of one of the vertebræ, apparently the second or third cervical. There was an oozing of a sanious fluid from it continuously and in considerable quantity. On the fourth day this fluid became quite clear, and on the fifth day some of it was collected for examination. It was limpid, of a pale straw colour, sp. gr. 1012, alkaline, and with a trace of albumen. There seemed to be no prominent symptom beyond pain in the neck, and nothing to indicate any lesion of the spinal cord. On the eleventh day, however, the pulse and temperature began to rise, and continued considerably above the normal till his death. It was not till the sixteenth day (three days before death)

that the inspirations are observed to be remarkably slow (twelve in a minute) and thoracic, "like a succession of long-drawn sighs." He was conscious up to the day before his death, and on that day when asked whether he felt pins and needles in his feet he said that he did. He had also complained of cramp and numbness in the right hand, but there seemed no satisfactory proof of any symptom pointing definitely to lesion of the spinal cord. Death was attributed to coma, the result of imperfect respiration. The oozing of fluid from the wound continued up to the last day of life. Its quantity depended partly on whether the wound was plugged or no, and partly on the movements of the patient. "After any considerable change of posture, such as to quicken the circulation, it welled out as from a spring. On one occasion, after it had been necessary to pass a probe into the wound and he had been supported up while this was done, it actually issued out *per saltum*, precisely as arterial blood would behave, and the movement was synchronous with the pulse." On the whole it was estimated that the loss of cerebro-spinal fluid averaged four to five ounces a day.

On post-mortem examination the dura mater corresponding to the second and third cervical vertebræ was of a darkened colour and softened. A probe introduced underneath at a point lower down and passed upwards, emerged readily through an opening, which was ill-defined in consequence of the disorganised condition of the membrane. The ligamenta subflava in this region were also highly vascular, and intimately attached to the dura mater by recent exudation. The arachnoid in the upper cervical region was injected, especially the parietal layer, and its prolongations encasing the posterior roots were thick and opaque. The vessels of the cord were here numerous and large, but its substance appeared healthy. There was no fluid in the subarachnoidean space. There was, however, some fluid in the ventricles of the brain. The brain substance is described as "hardly of natural firmness."

In this case it is rather difficult from the account of

the symptoms and post-mortem examination to make out the exact cause of death. The man was doubtless a lunatic, and the brain seemed somewhat softened; but that condition had apparently existed for some time, and the fatal result is distinctly referred by the surgeon in charge of the case to loss of function of the phrenic nerve, the origins of which were thought to be implicated in the inflammatory material poured out around the wound. Allowing this, we see that, apart from this merely incidental complication, the wound of the spinal theca, and the consequent loss of cerebro-spinal fluid, produced no symptoms whatever.

If, now, we compare the two cases just reported with the one which I related in the 60th volume of the 'Transaction,' we shall see so striking a resemblance as to justify a strong suspicion that that case also was one of wound of the theca vertebralis and not of the ureter. True, the flow was enormous, far greater than in Mr. Rouse's patient, and much greater than in Surgeon-Major Gribbon's case. But it seems natural that the flow should be more copious the lower down in the spinal canal the wound may be, whilst the greater quantity of fluid lost in any case as compared with Mr. Rouse's may have depended on a difference in the size or direction or freedom from obstruction of the wound. One symptom is common to all three cases, viz. the great increase in the flow which was produced by muscular movements.

These cases seem to me to have an important bearing on the physiology of the cerebro-spinal fluid, and on the consequences of its loss, for they go to show that its uses are purely mechanical, that it can be secreted (probably by mere filtration) in enormous quantity and with the greatest rapidity, and that its withdrawal, if not very sudden, is not accompanied by any symptoms whatever, so that Hirschfeld's assertion that "its loss in considerable quantities always causes death" is perfectly unfounded.

I am not quite so sure, however, that the sudden and total withdrawal of the cerebro-spinal fluid through a large

open wound would be equally harmless, though on this point our experience is not very considerable. The withdrawal of cerebro-spinal fluid in tapping a spina bifida does not seem ever to lead to any bad symptoms, but then the withdrawal is only partial and is counterbalanced by the pressure exercised on the tumour by the surgeon and by the atmosphere. Spina bifida tumours are, however, sometimes removed. Dr. Wilson, of Claycross, has related such a case in the 14th volume of the 'Path. Trans.,' and the operation was quite successful, and the same gentleman has, I know, operated on other cases successfully. But in the first case, at any rate, the tumour did not communicate with the subarachnoid space. In a case of the sort which I operated on many years ago no immediate symptoms followed the incision of the tumour and evacuation of the cerebro-spinal fluid. But in an infant in whom I removed a tumour which turned out to be spinal, *i.e.* to have a small pedicle communicating with the spinal theca, as soon as the cerebro-spinal fluid escaped the child fell into a condition of somewhat alarming syncope, and my friend Mr. J. H. Morgan, who was assisting me, told me that he had witnessed a similar occurrence at the Hospital for Sick Children. We can easily understand that even if the uses of the fluid are merely mechanical, and if it can be re-secreted as rapidly as possible, yet its too sudden withdrawal may cause great interference with the functions of the nervous centres which it supports.

APPENDIX.

The following case, for which I am indebted to Sir J. Paget, and in which the discharge of spinal fluid was spontaneous, *i.e.* due to perforation of the theca in disease, is very interesting, as showing that even when the per-

VOL. LXV.

foration is due to inflammatory ulceration, inflammation need not necessarily be propagated to the membranes of the cord. I give the case in Sir J. Paget's own words :

"A lady, about twenty years old, had carious ulceration of her sacrum, and after long suppuration was slowly wasting and slowly dying with hectic fever. One night there was a rapid flow of perfectly colourless and limpid fluid from one of the apertures of suppuration at the side of the sacrum. The sheets and blankets were widely wetted through ; but, except for the discomfort, she would not have known that anything had happened. Similar fluid continued to escape during the remaining week or ten days of her life, but I could not find any reason to believe that the escape hastened her death or in any way affected her condition.

"In the first flow I think that there must have been from four to five ounces of fluid, on each of the following days about two ounces, but it was impossible to collect it. It was all so colourless, clear, and limpid that I could not have a doubt about its being spinal fluid."