ON
IRRITATION OF THE SPINAL CORD
AND ITS NERVES,

IN CONNECTION
WITH DISEASE IN THE KIDNEYS.

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IN the following paper, cases will be related of disease in the kidneys existing in connexion with tenderness of the spine and paralysis of the lower limbs, which were, in consequence, treated as cases of disease in the fibro-cartilages and bodies of the vertebræ. Such instances not having been, as I believe, recorded, will probably be considered worthy the attention of the Society from their practical importance, and they may be interesting as illustrations of the pathology of the nervous system.

The first of these cases to which my attention was directed, occurred in the year 1818, in a man admitted into St. Bartholomew's Hospital, on account of

paraplegia combined with retention of urine. Both sensation and the power of motion were entirely lost in the lower limbs. On examining the spine, tenderness on pressure was discovered at the third lumbar vertebra, which, viewed in connexion with the other symptoms, was considered to indicate the existence of disease in the vertebræ, and an issue was accordingly made in this part of the spine. Considerable amendment of the symptoms followed. Sensation and the power of motion were in a certain degree regained, and the retention became changed into incontinence of urine. Here the improvement ceased, the general health failed, and he gradually sunk.

On a careful examination of the body, no disease could be discovered in the containing, or contained parts of the vertebral column; the vertebræ, fibro-cartilages, spinal cord, and nerves were all perfectly sound, as were also the brain and its membranes. In one kidney were numerous small abscesses dispersed through its substance. The other kidney was gorged with blood, and its substance was much softer than natural. The mucous lining of the ureters and of the bladder was very vascular, and the muscular coat of the bladder was thickened.

The next case occurred in 1821, in a man aged 35, admitted into the hospital on account of partial loss of the power of motion both in his upper and lower limbs, which had commenced about a month previously, and was supposed to originate in disease

of the cervical vertebræ. He suffered besides from irritation in the bladder with occasional inability to expel the urine which was mixed with some puriform fluid. In about six weeks from his admission, his health gradually declining, he died.

On examining the body, both kidneys were found gorged with blood. In the substance of one kidney there were small depositions of pus. The muscular coat of the bladder was thickened, and its mucous coat very vascular. No morbid appearance was discovered in the brain or spinal cord. The vertebræ and their fibro-cartilages were perfectly healthy.

For the particulars of the following case I am indebted to an intelligent friend, Mr. Henry Hunt, of Dartmouth.

A gentleman, aged 28, fell upon his back and bruised it, from which, however, he recovered in a few days. Some weeks afterwards, when very hot from violent exercise, he was suddenly chilled by exposure to a current of cold air. During the following night he was seized with severe pain in his loins, which was to a certain extent relieved, and principally by abstracting blood from the part. With the continuance of pain in the back, he began to lose feeling and the power of motion in his lower limbs. The pain in the back was increased by pressure, but was not influenced by the application of a hot sponge. He gradually lost almost all power of moving

and feeling in his limbs, with the ability to retain his urine, and in this condition he died.

On examination of the body, one kidney was found to consist of a mere sac distended with pus, and in the other kidney, were several small abscesses. There was no disease in the spine or in any other part of the body.

I next mention the brief particulars of a case which was furnished me by the late Mr. Horwood of Gosport, whose life was destroyed by cholera whilst he was engaged in the zealous performance of his professional duties.

The patient having suffered a fall upon his back which was followed by paralysis of the lower limbs, his complaint was, in consequence, considered to be disease of the spine, and the appropriate treatment was adopted and continued to the time of his death.

The appearances on dissection were, abscesses in both kidneys, thickening of the coats of the bladder with enlargement of the prostate gland. The thoracic and abdominal viscera were healthy. The brain and spinal cord were healthy excepting an unusual vascularity in the membranes of the latter below the first lumbar vertebra. There had not been the slightest suspicion of disease in the kidney, the pain in the back having been wholly referred to

the disease which was supposed to exist in the spine.

Here were four cases considered to be diseases of the spine, and treated accordingly, in which the vertebræ, their fibro-cartilages and ligaments were found healthy, and the only disease ascertained to exist was seated in the kidney, with which, therefore, we are to presume the irritation of the spinal cord was connected. To the question whether the irritation of the spinal cord might have been an independent affection with which the disease in the kidney was casually coincident, the proper reply will be presently considered.

It would be too much to state that from a closer investigation of the history in each of the foregoing cases, circumstances might not have been discovered determining the real nature of the disease which was proceeding to the destruction of life. With the attention alive to the possibility of mistaking a disease in the kidney for an affection of the bones and fibro-cartilages of the spine, the risk of so serious an error in diagnosis will be lessened, if not completely removed.

Mr. Burnett who was house surgeon at St. Bartholomew's in 1829, drew up at my request the particulars of the following case.

A man aged 22 was admitted into the hospital on

account of retention of urine, the consequence of a severe gonorrhœa, the discharge of which he had stopped by injections. The bladder then lost its expulsive power. The sphincter ani became paralytic, and he lost in some degree the power of moving his lower limbs. He also complained of severe pain in the back, at the fifth lumbar vertebra. His countenance was flushed and marked by extreme anxiety. The tongue furred, pulse 120, quick and sharp. Abdomen tense and distended, and painful on pressure, especially in the hypogastric region. He distinctly traced the course of his pain from the bladder upwards to the left kidney, then across his loins to the right kidney. His lower limbs became remarkably flabby, and after some time, the loss of power in them was complete as far as motion was concerned, and nearly so in reference to sensation, for when firmly pinched, he could feel it only in the upper parts of the thighs. Some urine dribbled away, and his fæces passed involuntarily. The urine drawn off from the bladder was dark coloured, offensive, and mixed with mucus. Aperients, the warm bath, local abstraction of blood, Dover's powder, &c., were the remedies used, but with little effect. A slough formed in the skin upon the loins and right hip. The pulse became weak and the tongue dry and brown. The urine diminished almost to a complete suppression, and in about a fortnight from his admission into the hospital he died.

On examination of the body, the kidneys were

found larger than natural, and of a very soft consistence. Sections of them discovered, with the turgescence of the blood vessels, numerous minute depositions of pus throughout both the cortical and tubular parts. The infundibula and pelves were filled with pus mixed with a thick, ropy mucus. The mucous membrane lining the bladder was very vascular, and in part covered by coagulable lymph. There was no morbid appearance discoverable in any part of the brain or spinal cord.

In this case we observe the same phenomena as in the four cases previously related, namely, inflammation of the kidneys, with paralysis of the lower limbs, but occurring under such circumstances as were not likely to lead to an opinion that the symptoms originated in disease of the spine.

In the present month (May) the following case occurred in St. Bartholomew's Hospital under the care of Mr. Earle. A man, aged about 30, was admitted three weeks previously, on account of a gonorrhœa with phymosis, which was in progress towards cure. The inflammation in the urethra had subsided, but the discharge continued. Whilst in this state, as far as the local disease was concerned, and without any particular derangement of the general health, he was suddenly seized with paraplegia, which extended as high as the umbilicus. In the limbs the loss of motion was complete, and the loss of sensation nearly so. The functions of the brain were

unaffected. On being questioned, he stated that he had been suffering for a day or two from pain in the loins. The pulse was 85, and rather full. He was cupped in the loins, and free action of the bowels obtained by purgatives, but with no benefit. The urine flowed involuntarily and in considerable quantity. As, however, it was thought the bladder was distended, a catheter was introduced, and three pints of urine evacuated. In sixteen hours from the attack of paraplegia, the man suddenly fell back in his bed and died.

With the recollection of the case last related, I ventured to predict that in this instance we should find inflammation in the kidneys. The spinal cord was first carefully examined. There was found some turgescence of the vessels, both in the membranes and substance of its lumbar portion, and a few drachms of transparent fluid in the theca, but neither the turgescence of vessels, nor the effusion of fluid were sufficient to explain the paraplegia by pressure on the cord. The liver was enlarged and indurated. The other abdominal viscera, with the exception of the kidneys, were sound, and with no unusual turgescence of the vessels. Both kidneys were of so dark a colour as to be almost black; they were remarkably flaccid, and on sections being made of them, were found to be in every part gorged with blood. The mucous lining of the infundibula and pelves was dark coloured from the turgescence of the vessels. The coats of the ureters and the mucous

lining of the bladder were also very much more loaded with vessels than is usual. In the bladder was about a pint of urine. Some fluid was found between the membranes of the brain and in its ventricles.

When the circumstances of the foregoing case are viewed with the other cases which preceded it, it seems reasonable to believe there was a connexion between the occurrence of the paraplegia, and the inflammatory state of the kidneys evidenced by the great determination of blood to their substance. Had life endured for a longer period, it is probable there would have been suppuration in the kidneys. From the period of the occurrence of the paraplegia there was an inordinate secretion of urine, which is worthy of remark in connexion with the great determination of blood to the kidneys.

Dr. George Burrows furnished me with the particulars of the following case which occurred in St. Bartholomew's Hospital under the care of Dr. Latham. A man, aged 35, was admitted with incontinence of urine and severe pain in the back which had existed above two years. The pain extended from the first dorsal to the last lumbar vertebra, but it was most severe at the sixth dorsal vertebra, and was increased by pressure. Pain also extended over the front of the chest, and he breathed with difficulty. Both the urine and fæces were passed involuntarily. Pulse 80. The abstraction of blood from the back by cupping glasses was followed by no alleviation of

pain, but the breathing became easier, and he passed his stools with consciousness. The difficulty of breathing returned with drowsiness. Blood was taken from the temples with but little relief; with increasing difficulty of respiration, he gradually sunk.

A considerable quantity of serum was found beneath the arachnoid membrane covering the brain. Serum was also found in the theca vertebralis, and the pia mater covering the lumbar portion of the spinal cord was very vascular. In other respects the cord was healthy. The thoracic and abdominal viscera were healthy, with the exception of the kidneys. The pelvis and infundibula of the right kidney were dilated and distended by a thin puriform fluid, and in some situations the substance of the kidney had been absorbed, so that the infundibula extended almost to its outer surface. On stripping off the capsule of the kidney, the cortical substance presented a mottled appearance from the alternation of white and red spots, but with a predominance of the former. The left kidney was in a similar condition. Both ureters were dilated. The bladder contained a pint of thin puriform fluid similar to that found in the kidney. The muscular coat of the bladder was thickened.

In the preceding case we note, in connexion with an altered structure in the kidneys, pain extending down the spine with the loss of sensation and muscular power in the bladder and rectum, which it may be

presumed was the effect of irritation in the spinal cord.

In subsequent communications with which I have been favoured from Mr. Henry Hunt of Dartmouth, he states that he had attended four cases of disease in the kidney existing in connexion with symptoms of affection of the spine, and that "the peculiarities of these cases appear to him to be, first, that the symptoms simulate those of the incipient stage of inflammation of the vertebræ, thus there are the numbness, cramps, and inability of commanding the legs. 2dly, that there is a peculiar feeling of tight wires or cords in different directions through the limbs. 3dly, that with the first stage of the inflammatory attack in the kidney, the urine is not altered in quantity or quality, and consequently it was pronounced that no disease in the kidney existed until it was indicated by the mixture of pus with the urine." Mr. Hunt further alludes to the occurrence of cases of disordered uterus combined with loss of power in the lower limbs in such a degree, that the patients were wholly confined to their beds, adding that, by the subsequent and perfect recovery of some of these patients, it was clearly proved there had been no change of structure in the parts to which the symptoms referred as the source of irritation.

It can hardly be imagined that in the foregoing cases, the combination of disease in the kidneys with

irritation of the spinal cord and its nerves was simply a casual coincidence. The number of the cases which have been related, and the striking phenomena they exhibit, will scarcely permit such a mode of reasoning respecting them.

The cases which have been described exhibit disease, apparently beginning in the kidneys, and communicating an impression to the spinal cord and nerves issuing from it. For the further illustration of this subject, it may be well to allude to the instances, of far more frequent occurrence, in which irritation, commencing in the spinal cord, is communicated to the kidneys and other parts over which the spinal nerves exert a direct control.

It has been observed in the different orders of animals, that the complexity of the sympathetic nerve is proportionate to the developement of the spinal cord *, hence the opinion that the ganglia of the sympathetic, as it were, having their roots in the spinal cord, derive from it whatever influence they communicate to the parts upon which the nerves issuing from these ganglia are distributed. The lumbar ganglia of the sympathetic communicate freely with the spinal nerves, and from these ganglia, nerves issue to the renal plexus. From this arrangement of nerves, an explanation may be derived of the

* M. Weber *Anatomia Comparata Nervi Sympathetici*. Leipsiæ, 1817.

influence of the spinal cord upon the functions of the kidney ; still more closely can we trace the influence of the spinal cord upon the bladder, rectum, and uterus, through the nerves which these organs receive directly from the sacral plexus of spinal nerves.

In the work of Ollivier on the spinal cord *, an experiment by M. Krimer is quoted to prove the direct influence of the spinal cord on the functions of the kidney. It consisted in dividing the spinal cord in its dorsal or lumbar portion, or in completely destroying either of these portions of the cord, and in either case, very remarkable changes immediately followed in the qualities of the urine ; it became colourless and loaded with saline and acid principles, no such effects resulting from injury to the cerebrum or cerebellum. Ollivier further quotes the observations of M. Bellingeri that in sheep, inflammation of the spinal cord and its membranes is frequently followed by inflammation in the peritoneum and in the kidneys, and that the urine then becomes altered so as to resemble coagulated serum.

Dr. Prout, in his work on diseases of the urinary organs, has noticed the effect of irritation of the spinal cord on the functions of the kidney by referring to the old opinion that injuries of the back produce alkalescent urine, and adding, as the result of his own experience, that in a large proportion of cases, the

* *Traité de la Moelle Epinière et de ses Maladies*, 2 tom. 8vo.

deposition of the earthy phosphates from the urine has been distinctly traced to some such injury as a violent concussion of the spine occasioned by a fall from a horse. More severe injuries of the vertebral column, as fracture and dislocation, are, it is well known, frequently fatal from inflammation of the mucous coat of the bladder induced by the contact of a highly stimulating ammoniacal urine. A case of this kind occurred in St. Bartholomew's Hospital in the autumn of 1831, wherein there was fracture with displacement of the fifth and sixth dorsal vertebræ with a complete division of the spinal cord at this part, and consequent paralysis of the lower half of the body. From the day of the accident, a catheter was introduced into the bladder every night and morning. On the fifth day, the urine became greatly increased in quantity, strongly ammoniacal, very thick, and of so dark a colour that it was considered there must be a mixture of blood with it. The urine remained in this state to the death of the patient, which occurred on the 26th day, and upon dissection, the bladder was found almost completely deprived of its mucous lining, only a few shreds of it having escaped the processes of sloughing and ulceration. This case is further interesting from the continuance of life for nearly a month after the complete division of the spinal cord in its dorsal portion. Another case has subsequently occurred in the hospital of fracture and dislocation of the spine, implicating the eighth and ninth dorsal vertebræ, followed by paraplegia. On the fourth day, the urine began to have

the strongly ammoniacal odour and to present the same reddish brown colour as in the preceding case. Portions of this urine were submitted to chemical analysis, and reported to be strongly alkaline and mixed with blood, which gave to it the reddish brown colour. From the loss of the expulsive power of the bladder, it was necessary, from the first day, to remove the urine by a catheter, which was introduced several times a day, with the view of preventing the accumulation of urine in the bladder. The abdomen on the seventh day became tympanitic and tender, and on the tenth day he died.

On examination, the spinal cord opposite to the injured vertebræ, to the extent of an inch, and in its whole thickness, had completely lost its natural characters of colour and consistence, it was extremely soft and mixed with specks of blood. The kidneys were very vascular, but not otherwise injured. The bladder was very capacious and externally of a dark red colour from turgescence of its vessels. Nearly the whole of its mucous membrane was sphacelated. The small portion of it which had preserved its vitality, was thicker and more vascular than natural, but its surface was not abraded. The great omentum was found spread over the whole contents of the abdomen, and its surface was covered by a layer of coagulable lymph apparently the result of recent inflammation of the peritoneum.

It becomes an interesting point of enquiry whence

in the preceding cases, the blood was derived, which was found so abundantly, and continuously for several days, mixed with the urine. In the first case, the extensive separation of the mucous membrane of the bladder by slough and ulceration might indicate that the blood had been derived from this source, but in the case last related, there was no abrasion of the lining of the bladder, and it may be reasonably conjectured that from impaired nervous power in the kidney, blood unchanged may have passed from the renal arteries and veins directly into the uriniferous tubes. In other conditions of disease, this tendency of the kidney to throw off the red particles of the blood is frequently noticed, and in such a degree that the urine seems to consist entirely of blood. In his remarks on bloody urine, Dr. Prout has stated, that "when the blood is derived from the kidney, it is generally equally diffused throughout the whole urine: on the contrary, when derived from the bladder, the blood, for the most part, comes away in greater or less quantity at the termination only of the urinary discharge, the urine having previously flowed off nearly pure."* According to this diagnosis, the blood in the foregoing cases of injury to the spine was certainly derived from the kidneys.

It has been usually considered that in cases of injury to the spine, the urine becomes rapidly decomposed in the bladder, because this organ has lost its

* Diseases of the Urinary Organs, page 296.

nervous power, but from observations recently made by Mr. Smith of St. Mary's Cray, Kent, it would appear that the urine is ammoniacal before it passes into the bladder from defective action of the kidneys consequent on the irritation in the spinal cord*.

That the irritable uterus, described by Dr. Gooch, is, in some instances, dependent on irritation of the spinal nerves, may be inferred from the control over the affection to be obtained by the application of an issue to the loins; and the following case will present a striking example of an irritable and very painful condition of the bladder arising from the same cause.

Charlotte Sepping, æt. 25, was admitted into St. Bartholomew's Hospital with the following symptoms. Pain and tenderness in the side just above the crista of the ilium. Urine very scanty and high coloured, and voided with great distress. She stated that she had been ill about a month, and that at the beginning of her illness, after straining to empty the bladder, she felt a sensation of something giving way in her side, and immediately passed a teacupfull of blood. She had occasionally passed gravel. She suffered most severely from pain in the bladder, and required the constant introduction of the catheter. From the suspicion there might be a stone in the bladder, she was sounded by Mr. Abernethy, who pronounced there was no stone, but that the bladder

* Medical Gazette, Feb. 1832.

was very irritable and without the power of contracting. Every form of medicine that was likely to relieve the irritability of the bladder was tried, but ineffectually; her sufferings continued, the pain in the bladder was excessive, there was also severe pain in the lower part of the back, and the urine continued to be mixed with clots of blood. On examining the spine, acute tenderness was discovered in the spinous processes of the lower lumbar vertebræ, and an issue was accordingly made in this situation. As soon as the discharge from the issue commenced, her sufferings began to subside, the bladder became gradually tranquil, and in about a month, she left the hospital perfectly well, and it was afterwards ascertained that she had no return of the complaint.

Whatever opinion may be formed respecting the nature and treatment of this case, the facts of it are these, that from the multitude of remedies tried, no relief was obtained until the establishment of the issue in the loins. Then the bladder began to be tranquil, and eventually it regained a healthy condition without the employment of any other remedy. Mr. Abernethy considered the case as one of irritable bladder, dependent on irritation of the lumbar nerves, and the progress of it was carefully noted by Dr. Roupell, to whom I am indebted for the principal circumstances of its history.

In reflecting upon the phenomena of the first series of cases which have been detailed in this paper, it

might be thought improbable that irritation commencing in the kidney, or in the bladder, should be propagated through sentient nerves to the spinal cord, and that the impression should thence be transmitted through both the motive and sentient spinal nerves to the limbs, here occasioning an impairment both of sensation and of the power of motion. Some illustration of this subject seems to be furnished by the following researches of experimental physiology. If in an animal, "a few seconds after it has been deprived of life, the spinal cord be then divided in the middle of the neck, and again in the middle of the back, upon irritating a sentient organ connected with either isolated segment, muscular action is produced, that is to say, a sentient organ is excited, and an irritation is propagated through the sentient nerve to the isolated segment of the spinal marrow where it gives rise to some change which is followed by an impulse along the voluntary nerves to the muscles of the part."* In the instances which have been adduced, irritation commencing in the nerves of an internal organ, the kidney or bladder, has been transmitted through the spinal cord to the motive and sentient nerves of the limbs; but the same phenomena may occur in an opposite order, as in the case of a compound fracture or other severe injury of the lower extremity followed by retention of urine, from irritation arising in the anterior crural and ischiatic nerves, and communi-

* Outlines of Human Physiology, by Herbert Mayo, edit. 3d, p. 231.

cated through the lumbar and sacral plexuses of spinal nerves to the nerves of the bladder.) Extending these views to cases of neuralgia, where there is no visible derangement of structure, or other local cause of excitement, it will always be difficult to determine whether the source of irritation be in the affected nerves, or in the central portion of the nervous system whence they are derived. In one case of neuralgia affecting the nerves of the thigh, after ten years of severe suffering, the patient died, and upon dissection, with a perfectly healthy condition of every other organ, the lumbar portion of the spinal cord on its posterior surface, was found covered with numerous large, but thin plates of cartilaginous substance, deposited in the arachnoid membrane. Here it must be, I conceive, difficult to state whether the morbid condition of the spinal cord bore the relation of cause or effect to the painful affection of the nerves of the thigh.

In a comprehensive view of the various phenomena associated with disease of the kidneys, it would be necessary to notice the marked influence of these organs upon the brain, the explanation of which is to be found in a paper recently read by Dr. James Wilson at the College of Physicians *. But in the present paper I have simply intended to illustrate by a variety of facts the reciprocal connexion between the kidneys and the spinal cord, of the importance of which there can be no doubt, when we consider that

* Medical Gazette, March 9th, 1833.

until by more exact observation, our diagnosis is improved, cases of paralysis in the lower limbs may be submitted to us, in which we may feel uncertain whether it is a disease of the spinal cord, or of the kidney, to which our treatment should be directed.