ABOUT THE NEUROLOGICAL SEQUELAE OF HERNIATED INTRAVERTEBRAL DISC^{1, 2}

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OBSERVATIONS on neurologic complications of herniated lumbar disc in 24 patients (19 hospitalised and five seen in consultation, 22 men and two women), although of different aetiologies, seem to be interesting enough to draw attention to a difficult semiology and to a particular type of neurological sequelae.

As seen in Table I the hernia was responsible in the first 14 cases, surgery in five cases (one associated with hernia and one associated with hernia and narrow lumbar canal), methiodal in six cases. One indefinite case (no. 24) remains where surgery and methiodal have not been stated precisely.

In observation number one it seems likely that the vertebrotherapy by traction had a bad effect because urinary disorders appeared following the first traction and an acute urinary retention took place immediately after the 13th traction. A narrow lumbar canal was seen in four cases, one of them showed sacralisation of L₅ and a thickening of ligamentum flavum. The pseudo-arteritis symptomatology of the narrow lumbar canal was not found in any of these cases.

Hernia was found in 23 out of 24 cases. With regard to the localisation, the majority (12) involved L₄₋₅ and nine affected L_{5-S1}. There were five double hernia. Several 'transitional anomalies' were seen, such as sacralisation or lumbalisation which are favourable for discopathies of the intervertebral space situated above the abnormal vertebra.

The youngest was 26 years old, the oldest 66. Practically half of this group were of some 40 years of age. In 16 cases out of 24, the duration was more than two years, in 19 cases more than one year.

The outset was acute in one case on awakening. Vertebral trauma was found in the history in this case as well as six others. In one of them, where the first lumbago crisis began after a ski accident, a huge hernia L₂₋₃ was removed three months later and there was a fracture-compression of D₁₂ and L₁.

THE CLINICAL ANALYSIS

Apart from the genito-sphincteric functional aspects and the classical neurologic examination, this type of lesion localised in the lower lumbar and especially sacral regions, necessitates a certain number of special examinations. The results are summarised as follows:

- anal, perineal, vesical tonus;
- ano-rectal, vesico-sphincterian, genital reflex functions;
- sensibility of detrusor, urethra, anus, rectum;
- voluntary control of sphincters and perineal muscles.

¹ Key words: herniated disc, sacral semeiology, vascularisation of conus, genito-sphincterians signs of disk protrusion.

² Paper read at the Annual Scientific Meeting, Heidelberg, 1972.

TABLE I
Aetiology of neurological sequelae

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Hernia	++	++	++	++	++	++	++	++	++	++	++	++	++	++	+	+	+	+	+	+	+	+	?	+
Surgery	+	+	+	+	+	+	+	+	+	+	+	+	++	++	++	++	++	+		+		+		+
Methiodal				+											+	+		++	++	++	++	++		++
Narrow lumbar canal						+								++		+	+							
Vertebral elongations	+																							

Each vertical column corresponds to a case (24 cases). The sign + means the factor is present, ++ it is causal.

It is beyond the scope of the paper to discuss in detail the special examinations peculiar to each parameter. It should be noticed however, concerning the reflex function, that the anal reflex like the bulbo-cavernosus reflex, may not be seen but only felt with the finger. The bulbo-cavernosus contraction may sometimes be felt on the muscle and not in the anus. In women, the clitoris-anal reflex is identical to the bulbo-cavernosus. Evidences of a reflex activity may be found either in the contraction of perineal muscles or of the anal sphincter in response to coughing, abdominal pressure or sudden inspiration (Bors & Comarr, 1971). Activity can be limited to only the striated urethral sphincter.

The analysis of the neurological lesion is difficult because the sacral segments are of a very small size, practically all grouped in front of L1, while at the dorsal level there is nearly one segment per vertebral body. On account of this fact, the nuclei lay close together and the sacral motor metameres are far from being well defined. Differences of opinions exist between authors concerning injuries below L4, about the situations of motor nuclei for certain muscles of the lower extremity as well as for the detrusor, rectum and the whole perineal muscles. Until the distal neuro-muscular physiology is defined, the possibilities of muscular testing ends at present at the level of S2, and we can only appreciate by the finger if a voluntary contraction of the perineal muscles and anal sphincter exists or not. The voluntary stop of urinary flow is also a proof of voluntary activity of the urethral sphincter.

Electromyography cannot be used systematically, but in one case revealed an anal sphincter activity, which was not detectable clinically.

The frequently incomplete type of these lesions (16 cases out of 24), make things more difficult for interpreting symptoms. The presence of the anal reflex or bulbo-cavernosus is much more difficult to interpret when the lesion is incomplete.

THE TYPE OF LESION

Though there was a sphincter resistance to urine evacuation in nine cases the authors were only able to find signs of a central type of lesion in three cases. Which criteria may be obtained to assert in such cases that a lesion is of central type?

We have not seen any pyramidal signs in the foot and toes in any of the cases studied. The ankle reflex was abolished 36 times and normal 12 times (in 48 lower extremities).

An anal reflex, the reflexogenic zone of which is totally anaesthetic or goes beyond the area S2-S5;

Contraction (involuntary) of the anal sphincter caused by finger-stretching;

Un-inhibited contractions either to the cystometry or to the rectometry;

Facilitation reflex starting of micturition or defecation (one of our patients used the coccyx rubbing to facilitate the beginning of micturition);

The reflex start of an automatic miction is elicited by the passage of faeces.

Among mistakes made, the false 'Babinski', *i.e.* extensor response caused by paralysis of toe flexors, should be mentioned, furthermore the loss of the opening reflex of the striated urethral sphincter. This abnormality, interpreted as a pyramidal sign in an upper motor lesion, may only be due to an interruption of the 'sensory arc'. Therefore, a lesion of the lower sensitive neuron at the level of

posterior urethra, is probably enough to abolish the opening reflex of the striated sphincter.

On the whole, these low lesions are very polymorph. Only two were complete and peripheral. In all others, a normal and/or central activity were being associated with peripheral signs. We find here a type of lesion similar to that in some tetraplegic's hands, where we see at the same time peripheral deficits, showing the lesional syndrome, central deficits and muscles having kept a voluntary function; two or three of these possibilities may exist on the same muscle.

Motor Deficiency of Lower Limbs. Nine patients had either never had or had recovered from lower extremity deficiencies. In the others the deficit was usually moderate: three walked with two crutches, five with only one, three were using only orthopaedic shoes, 13 walked normally. The most injured muscles were the triceps surae and biceps femoris, the flexor digitorum, brevis and longus peroneus, posterior tibial and gluteus maximus.

This more or less complete integrity of motricity may cause damage to the patient if the physician or surgeon judge the result just on what he sees, *i.e.* the type of walking. For lack of time or ability severe genito-sphincteric sequelae have been ignored or at least underestimated.

Sensory Deficiency. Disturbances of superficial sensibility were present in each case. Their upper level is usually situated higher (24 out of 48 lower extremities at the level L5 and S1) than the motor level (20 out of 48 at the levels S1 and S2).

Apart from the sensory deficiency subjective sensory symptoms are frequent, not only the lumbago that persist or sometimes re-appear after surgery, but pain or dysaesthesia, entirely localised to the buttock, perineum or to the anus or to the genital organs. Seen in seven cases, sometimes aggravated by prolonged sitting, temporary rather than permanently, the pain in the sacral region often resembles a burning sensation or throbbing, sometimes perineal or anal dysaesthesia is present (numbness, prickings, or electrical discharges). Two patients had pelvi-perineal pain when straining and one experienced over a period of several months some sensation of phantom erection, which disappeared gradually.

GENITO-SPHINCTERIC DEFICIENCIES

These are by far the most important and justify in themselves admission to paraplegic centres.

The three visceral, rectal and genital functions are far from being abolished completely, or even equally injured. Conversely no two cases are alike, and in half of them the deficiency prevailed largely in one or two of these functions. Thus one patient had a totally insensitive bladder with urine retention, a completely normal rectal function but little impaired genital function. Another had no control over micturition and defaecation, he went to the toilet 10 or 15 times a day to avoid faeces leakage but had appropriate erections with only few premature ejaculations.

The vesical function is governed by sensory deficiencies: the feeling of normal desire is almost always missing (21 cases out of 24); more often it is a sensation of suprapubic fullness or vague abdominal distension which arises when the bladder is very distended with a capacity considerably exceeding a litre. The

urethral sensibility is equally missing in a majority of cases, sometimes dissociated between posterior urethra and anterior urethra.

Two patients were admitted with an indwelling catheter. Several had uncontrolled and very incomplete micturition. Only one had a hydronephrosis with uraemia up to 1 g., but he had a prostatic adenoma which was, at least in part, responsible for the back pressure on the kidney. Five patients had a strained bladder and one had the neck resected.

When a sphincteric resistance is responsible for retention, it is necessary to act upon the striated sphincter through pudendal or para-sphincteric anaesthetic infiltrations, or continue with either intermittent catheterisation or indwelling catheter. When the lesion is stabilised (an unchanged neurological result over three examinations taken at intervals of two or three months is required) a sphincterotomy may be indicated.

In an incomplete lesion with little voluntary control of the perineum micturition has been made easier through relaxation. In another case where the abdominal pressure was insufficient and caused lumbago, the wearing of a corset lombostat allowed complete evacuations.

The aim of acting on the sphincter is not only to avoid back pressure on the kidney but also to avoid other complications of pressure: anal haemorrhoid, vaginal prolapse and inguinal hernia. Also, as is seen in similar syndromes of other aetiologies, diaphragmatic hernia or reflux of urine into seminal vesicles, ureters or into the diverticules may occur with the possibility of infectious complications.

When the perineum is flaccid and descends under abdominal pressure considerably increasing the trigone angle and the posterior urethra, palliatives can be tried, sometimes spontaneously imagined by the patient, *e.g.* a hand on the perineum, sitting on a hard support or better still on a tennis ball. A more adapted micturitional position seems to be on the toilet, the trunk leaning forward. We do not have experience of bladder fixation by surgery.

The ano-rectal function is also influenced by the disorders of sensibility and the discomfort caused by the uncontrolled leakages during effort, in particular, the micturitional effort. When there is no anal reflex action and no voluntary control of the anus, it is rare that the patient is not exposed to accidents. They can be diminished through a rigid discipline, regulating the diet and the regular evacuation of stools with the aid of the finger-cot, one, two or three times daily. We can imagine the psycho-social repercussions of such incidents, even if they are infrequent.

The genital function is often deficient: among 22 men the erection was normal in only two cases and ejaculation in only one. It is also thought that possible repercussions of such disturbances are probably of more importance if the motor handicap is slight. Although they had returned to work, two patients, without motor handicap and a most incomplete lesion, were very preoccupied by this. One, a 50-year-old man, had a total loss of erection except in the mornings when the bladder was full. The other, a 26-year-old, had short, painful incomplete erections and uncontrolled ejaculations.

Pathogenesis. We shall quickly pass over methiodal, which has been given up, the direct toxicity of which was demonstrated by Harvey *et al.* (1961) and his colleagues on the cat, where the methiodal obstructed the conduction of the anterior and posterior roots. Funkquist and Obel (1961) described spinal cord and root

impairments on the dog. Wolman (1966) found the same impairments in human pathology following sub-arachnoidal injections of anaesthetic products, such as phenol, alcohol or certain antibiotics.

As for the pathogenesis of hernia or surgery complications, it does not appear to be one-way. The direct radicular trauma definitely plays a part in some cases. Conversely trauma and compression can be aggravated by the oedema of all the nerves of the cauda equina, sometimes strangulated in the dural 'sack', and bulge out at the dura opening (Lazorthes, *et al.* 1966). The mechanism is probably the same in certain post-surgery complications where a re-opening discovers a huge haematoma (two of our cases). Lastly, the presence of pyramidal signs with a lesional syndrome exposes the ischaemic pathogenesis. Today the vascular abundance of the cauda equina is known: there is an artery for each root which goes to the conus medullaris, some of them flowing into the anastomotic loop of the conus, which joins the anterior spinal artery with the two posterior sacral arteries. Are these radicular arteries functional? It is probable but has not yet been demonstrated. It is only known that they can irrigate the spinal cord and even the lumbar swelling in the case of the Adamkiewicz artery deficit. Lazorthes (1966) reported the exceptional observation of a 65-year-old man who died from a haemoptysis and in whom a total vascular injection with 'baryte' revealed a thrombosis of a lumbar and Adamkiewicz arteries. The lower supplies and the vascular 'trident' of the terminal conus were well developed. As this man had no neurological deficiency it is likely that the sacral radicular arteries were functioning as substitutes for the thrombosed arteries.

CONCLUSION

Twenty-four cases of neurological sequelae due to herniated discs were studied as well as their semiological aspects. The conclusions are:

1. The study is made difficult as the nuclei of the sacral cord are very close to each other. Sacral segmentation and interpretation of the incomplete lesions (16 cases) is still not precise.
2. Two lesions only were of the lower motor neuron type. All the others had associated peripheral signs with normal and/or U.M.N.L. activity. One can find the same types of lesion in the tetraplegic hand.
3. The confirmed existence of U.M.N.L. symptoms in three cases at least allows us to say that a lumbar disc can give a conus medullaris lesion. Although the role of the radicular sacral arteries is not as yet well known, vascular aetiology is most likely. Hence, the name of these sequelae: conus medullaris and/or cauda equina lesion.
4. Surgery, which is not without danger, is indicated in certain cases, the most urgent being a hernia with an acute retention of urine, which must be operated within 24 hours (one of our cases). The narrowing of the lumbar canal as shown for the first time by Verbiest (1955) should be looked for more often by radiological measurements. It implies an extensive laminectomy in length and width.

In cases where the neurological symptoms appear gradually with discrete genital and sphincter symptoms the indication for operation is less urgent, but must be performed as they have never, in the authors' experience, recovered spontaneously.

5. The genito-urinary symptomatology in a herniated disc lesion is too often overlooked.

Among several of the subjects studied it was surprising to find the presence of neurologic signs during months, and even years in one case. They were apparently minor, compensated or tolerated until the appearance of the cauda-equina syndrome. Emmett and Love (1971) recently reported 35 cases of herniated disc with urinary symptoms seen in four years, 26 being without deficiency, either motricity or cutaneous sensitivity, and where the hernia has always been confirmed by surgery. On the other hand, Rosomof and Coll (1970) practised radiculographies and cystometrogrammes in 100 patients who presented lumbo-sciatica or other radicular compressions. Of these there were 77 hernias of the intervertebral disk whereas 12 subjects only presented bladder disorders, 83 had an abnormal 'cystometrogramme' with a more or less important bladder insensitivity and incomplete retention.

When the importance of the S2 segment and roots in the innervation of the detrusor are known and the frequency of the bi- or multi-radicular forms of sciatica is correlated, one is tempted to put forward the value of the neuro-urological semiology in lumbar hernias and hope that the genito-urinary symptoms particularly, the dominating sensory deficiency and the incomplete urinary retention will be looked for.

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