sensitive granulation tissue. Dressings are so arranged and the timely use of the silver nitrate stick is so regulated that the shallow saucerized cavity heals up slowly and steadily from the bottom (Fig. 4). As time goes on, dressings will be required less frequently, but the patient will probably have to remain in hospital for three weeks, and for three weeks thereafter be visited by the district nurse for daily dressings. The wound generally heals completely in six weeks with the formation of a scar that is far less unsightly than might be anticipated, and recurrence is exceptional (Fig. 5).

Credit for recognizing the true nature of these lesions belongs to Zuska, Crile, and Ayres (1951), who appreciated the fistulous nature of the condition and were the first to

FIG. 4.—Healing is taking place by granulation. FIG. 5.—The resulting scar four weeks later.

likened it to fistula in ano. They failed to recognize, however, the common association of this lesion with previously indrawn nipples, which was apparently not a noticeable feature of the five cases they describe. Kilgore and Fleming (1952) reported on 64 patients with subareolar abscess; they remark on the tendency for these abscesses to recur, and observe that carcinoma was not associated with the condition in any of their cases. These authors find, as might be expected, that antibiotic therapy is of no avail. After a trial of many methods they finally conclude that the proper method of treatment is on the principles described above.

Present Series

Since the last war I have treated 28 of these cases, and features of the series are noted in the Table. This Table requires little amplification. In one case, in addition to the 19 quoted as having inverted nipples prior to the infection, the nipple which had previously been normally protruded became inverted subsequent to the onset of infection. The age of the patient on whom biopsy of the track showed duct

Features of Present Series

Total number of cases (all female)	28
Married	25
Bilateral affection	7
Nipples previously inverted on the side or sides of lesion	19
Associated with late months of pregnancy or lactation	7
" " malignancy	1
Average age	34 years
Age range	21-63

carcinoma was 47, and a radical mastectomy was at once performed on this side. In two of the cases the infection was associated with pregnancy and a fresh abscess occurred with each subsequent pregnancy—on one case three times, and in the other four times.

In the early years these cases presented a troublesome therapeutic problem. Following the customary practice, we would incise the septic collections as they appeared, and the inevitable recurrence was a source of grave aggravation to the patient and of anxiety to us. Multiple operations and repeated courses of injections with antibiotics were the rule. One case with bilateral fistulae had had over twenty operations for drainage of these abscesses before attending the

breast clinic, and bilateral mastectomy had been recommended by two surgeons. This lady, aged 23, had recently married, and the prospect of losing both her breasts drove her to seek further advice. Fortunately she arrived on the scene at a time when the nature of this condition had begun to be appreciated, and adequate saucerization led to complete healing.

Since adopting the procedure described above we have had no recurrence in this series to date, but in view of the possible association of this disorder with carcinoma a biopsy of the track should always be performed.

Summary

The term mammillary fistula is suggested for a common inflammatory disease of the breast which has been almost unrecognized. The treatment for this condition, on the lines of that practised for fistula in ano, is described, and a note on 28 cases illustrates the main features of the syndrome.

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DIAGNOSIS AND TREATMENT OF MYELOPATHY DUE TO CERVICAL SPONDYLOSIS*

BY

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This paper provides a review of 39 patients with cervical spondylosis that have been treated by operation, in all of which the neurological manifestations clearly indicated that the cervical spinal cord had become damaged. A wider review of the subject, including a comparison of the results of conservative and operative treatment, has already been published (Brain, Northfield, and Wilkinson, 1952). Treatment of the spondylosis itself is beyond the scope of this paper; indeed, if the spondylosis is painless the spinal condition passes unrecognized until neurological disturbances become manifest. These can be crippling in their effect. Whether the prevention of myelopathy in a person known to have spondylosis can be achieved by simple means is a subject to which little attention has yet been paid. The *Lancet* (1955) states: "It behoves us as we grow older to adopt a more regal posture and bearing, and to avoid all rapid, undignified movements of the head and neck."

Radiology of the neck reveals that spondylosis is a common enough condition from middle age onwards, but we do not know the factors which determine the development of myelopathy in one patient and not in another (though they may apparently have the same degree of spondylosis), nor why the rate of evolution of symptoms varies so widely. In the cases under review the shortest duration of symptoms was six weeks, and the longest twenty years. Delay in seeking medical help and delay in arriving at a correct diagnosis do not fully account for this. Natural variations in the diameters of spinal canals may make some spinal cords more vulnerable than others. The speed of growth of osteophytes and the question whether one or more disks

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become affected are probably related to a greater or less extent to congenital malformation, stresses due to type of employment, trauma, and an inborn susceptibility to premature senile changes in the tissues. At present all one can do is to endeavour to recognize neurological symptoms due to spondylosis, and to choose the appropriate treatment.

Symptoms

The symptoms can be broadly classified into three groups; those related exclusively to the skeletal changes of spondylosis; those indicating a lesion affecting a cervical spinal root; and those due to interference with spinal-cord function.

1. It is rare for pain, stiffness, or limitation of movement of the neck to be an outstanding symptom. Moreover, minor complaints of this kind, like other joint troubles, are common enough in all adults of advancing years. The presence or absence of such complaints is of little help in diagnosis.

2. *Spinal-root Manifestations.*—Pain radiating into the shoulder, into the arm, hand, or digits, or into the chest wall; at times its distribution is clearly of root pattern, and it may be aggravated by appropriate movements of the neck. *Paraesthesiae*: burning, tingling sensations, vague in distribution, often spreading to the digits. *Loss of sensation*: numbness or inability to recognize objects by touch is a frequent and disabling symptom. *Weakness* of the upper limb, usually selective, accompanied by wasting.

3. *Spinal-cord manifestations* may occur first in either the upper or the lower limbs, as a spastic weakness and clumsiness, often bilateral but by no means necessarily so. Paraesthesiae and pain in the trunk and legs may wrongly focus attention upon the thoracic region as the site of the lesion. Ataxia may be considerable. Symptoms of disturbed bladder control are not common except in advanced cases; in 10 cases there was slight disturbance of micturition, and in 4 there was retention or incontinence of urine. In Table I is set out an analysis of the ages of the patients, of the duration of the history from the first recognizable neurological symptom, and of the first symptoms. About two-thirds of the patients were between the ages of 40 and 60 years, and in nearly one-half the symptoms had been developing for periods of over two years. Trauma of sufficient degree to be a well-remembered incident occurred in 13.

TABLE I

Age Incidence:					
30-39 years	..	40-49 years	..	50-59 years	..
5		13		14	
Duration of Symptoms:					
Up to 6 months	..	1 year	..	2 years	..
6		9		8	
Trauma in 13 cases					
Initial symptom:					
Weakness or stiffness of one or both legs	..	..	..	..	16
Numbness or paraesthesiae in arm or fingers	..	..	..	..	7
Weakness or clumsiness of one or both arms (and digits)	..	..	..	..	6
Pain, cramps, paraesthesiae in legs	..	..	..	..	7
" in upper limb(s)	..	..	..	..	5
" and stiffness of neck	..	..	..	..	3
Girdle sensation	..	..	..	..	1

Physical Examination

Neck.—There may be an exaggeration of the normal cervical lordosis, often accompanied by a dorsal hump. Movements may be slightly restricted and painful. Examination of the neck commonly reveals little abnormality.

Motor.—Wasting may be evident in all limbs, though usually more severe in the upper than the lower; it need not be symmetrical; it may affect all the muscles of the upper limb equally, though usually particular groups having a common segmental origin are picked out. Wasting of the intrinsic muscles of the hands is often seen, even with disk lesions as high as C 3-4 or C 4-5. Fasciculation commonly accompanies severe wasting. Variation in muscle tone depends upon the level of the lesion and the relative

incidence of damage to upper and lower motor neurones. If the spondylosis is above the cervical enlargement all limbs will show some spasticity; at mid- and lower-cervical levels some muscles will be flaccid and others spastic. In the lower limbs spasticity is often severe, of a degree disproportionate to the weakness, and the resulting stiffness causes much disability. Weakness similarly varies greatly, by no means affecting all the limbs to a similar degree. The diagnostic problems are aggravated by the observation that careful assessment of weakness does not always lead to a correct diagnosis of the level of the lesion. Muscles arising from segments of the cord above the vertebral lesion may show spastic weakness, suggesting that the myelopathy even in a case of single disk lesion is diffuse, perhaps owing to vascular disturbances.

Reflexes.—Tendon reflexes in the upper limbs are usually increased, though, depending upon the degree of damage to lower motor neurones, there may be depression or absence of a tendon reflex. Such discrepant or anomalous findings, including an inverted radial reflex, are of great value in distinguishing spondylotic myelopathy from disseminated sclerosis and other degenerative long-tract diseases. Diminution or absence of the abdominal reflexes, increased knee- and ankle-jerks, and extensor plantar responses occur in accordance with the degree of pyramidal damage.

Sensory.—Careful search for disturbances of sensation, both superficial and deep, is of particular importance. The disturbances may be slight enough to escape detection easily; their presence makes the diagnosis more probable, and the absence of sensory impairment should lead one to scrutinize the evidence carefully before accepting cervical spondylosis as the cause of symptoms. The upper limbs show some abnormality in most cases, cutaneous sensation being impaired in about three-quarters. Severe loss is uncommon; it may be restricted to a root level in the upper limbs, or it may spread on to the trunk. In high lesions a level to dragged pin may be found at the collar level. In the lower limbs sensation may not be affected, though search for impaired appreciation of posture and vibration is often repaid, as damage to the posterior column is often demonstrable when other forms of sensation are intact.

Micturition may be impaired, though the cause of this symptom may be difficult to assess in men of the age groups under consideration.

In Table II is set out an analysis of the findings in the cases under review. The category "symptomless" in motor disturbances of the lower limbs is used for those patients who did not have symptoms of weakness, spasticity, or ataxia, but in whom examination revealed unequivocal evidence of pyramidal damage, thus bringing them into the

TABLE II

Upper limbs	Motor disturbance slight	..	27
	" " marked	..	9
	Sensory " slight	..	18
	" " marked	..	5
Lower limbs	Motor disturbance symptomless	..	11
	" " moderate	..	18
	" " marked	..	10
	Sensory " slight	..	9
	" " marked	..	13
	No sensory disturbance in upper or lower limbs	..	11
	No abnormalities of upper limbs	..	2
	(Slight disturbance	..	10
Micturition:	Retention or incontinence	..	4

class of myelopathy, though the signs in the upper limbs were perhaps otherwise compatible with a purely cervical root lesion. "Marked" motor disturbance in the lower limbs means that the patient needed assistance in order to walk, or was bedridden.

Diagnosis

It will be apparent that the manifestations of spondylotic myelopathy can provide a great variety of clinical patterns. All the causes for such profusion are not yet understood. But tangible factors which modify the picture are the level of the disk affected, whether only one or several disks are

degenerate, and whether the distribution of the osteophytes is such as to involve the spinal roots as well as the spinal cord itself. In the present selected series there were 22 cases in which only one disk was affected. Osteophytes may cause such constriction of the intervertebral foramina as to squeeze their contents. Apart from adding a radicular element to the picture, it is possible that this leads to or aggravates ischaemic changes in the cord by strangulation of the entering arterial radicles which augment the blood flow in the anterior spinal artery.

There may evolve a picture of quadriparesis due to compression of the spinal cord above the cervical enlargement, thus mimicking a tumour at or below the foramen magnum. Or the upper limbs may show involvement both of upper and of lower motor neurones, either element predominating. It may be clear that the lesions are multiple, or that the cord damage extends over several segments. Rarely, the upper limbs are entirely spared, and the patient presents with paraparesis. The relative degree of motor and of sensory abnormality shows great variation, though a purely motor picture is uncommon. The long duration of the symptoms and their slow progression, with at times periods of stabilization, make disseminated sclerosis a common alternative diagnosis, hence the need to seek other signs of that disease. Diminution or absence of tendon reflexes in the upper limbs and an inverted radial reflex are valuable in indicating the true diagnosis. Amyotrophic lateral sclerosis closely simulates spondylotic myelopathy, and search for sensory disturbance is well repaid. Spinal tumours, intramedullary and extramedullary, enter into the differential diagnosis and indeed may be revealed only at operation. The pattern of sensory loss may invite a diagnosis of syringomyelia, and subacute combined degeneration may be simulated. The occasional absence of abnormal signs in the upper limbs may lead to a diagnosis of thoracic tumour, and if myelography of this region proves negative the correct diagnosis may not be considered.

Pain spreading into the arm and digits, and into the pectoral region, may be regarded as of cardiac origin, and slight long-tract signs indicative of spinal cord disease can escape detection if the examination is perfunctory. Even if the myelopathy is severe, chest pain may yet be cardiac, and thus contraindicate operation; in this event a cardiologist's opinion will be helpful.

The mere presence of radiological evidence of damage due to spondylosis, common over the age of 50, does not necessarily mean that the neurological disturbance is due to that disease. Spondylosis occurs in conjunction with other nervous diseases, including intraspinal tumour. In two of the present cases the manner in which the disease progressed after operation has led to the belief that the final diagnosis may be motor-neurone disease.

Investigations

Lumbar puncture does not often provide help in diagnosis. Increase of the protein content of the C.S.F. and evidence of spinal block—partial or complete—are of value in spinal-cord compression, whatever be the nature of the lesion. But in most cases the fluid is normal in content and hydrodynamics. Serological tests are carried out to exclude syphilis.

Radiology is of the greatest importance, and the cervical spine should be radiographed in every case of suspected spinal-cord malady in which the diagnosis is not immediately apparent. Films need to be taken in the antero-posterior, lateral, and oblique positions. Narrowing of the intervertebral disk intervals practically always accompanies osteophytosis, and is best detected in the lateral views. Sometimes the spurs of bone are so slightly ossified that an under-exposed film is necessary to demonstrate them. The antero-posterior and oblique views are valuable for revealing lipping of the neuro-central joints of Luschka and narrowing of the intervertebral foramina. In advanced conditions the neuro-central osteophytes are continuous with those arising from the rest of the margin of the vertebral body, to form an

osseo-cartilaginous bar extending transversely across the spinal canal. Degenerative changes are commonly found at more than one level. On occasion congenital fusion of two bodies may be present, the disk immediately above or below being the seat of degeneration. This is presumably the site of increased stress consequent upon the diminished flexibility of that portion of the cervical spine. Sometimes degeneration of the affected disk leads to such a degree of abnormal mobility that in flexion and extension the upper vertebra slides forwards and backwards on the lower. This subluxation can be demonstrated in lateral films taken at the extreme ranges of movement. The forward slipping narrows the spinal canal and thereby gives rise to repeated minor traumata of the spinal cord.

Myelography is the final step in diagnosis, so that the indentation of the column of opaque oil by the spondylotic excrescence can be visually proved and recorded. This is essential on several counts. (1) Large posterior osteophytes may be seen in the lateral films apparently impinging on the spinal canal; but in fact they may be situated sufficiently lateral not to impinge on the spinal cord. (2) Osteophyte formation and disk-narrowing may be inconspicuous and thus dismissed as a causal factor, but myelography may nevertheless show a large filling defect. (3) Myelography may reveal that the offending protrusion is at a higher level than the plain films suggest, or that there are multiple lesions. (4) Myelography can confirm the importance of subluxation, which may necessitate spinal fusion.

Treatment

Operation has consisted primarily of a suitable laminectomy, removing the lamina above and below the offending bar. Thus, in cases with a lesion at one level only, two neural arches have been removed. In multiple bars the rule has held good, so that if three contiguous disks have been involved, four neural arches were removed. It is of some importance to note that, whereas extradural palpation may disclose only a slight elevation at the site of the disk, gentle palpation within the dura mater anterior to the cord may make it very clear that nearer the midline the osteophytosis is much more prominent. The ligamenta denticulata were divided for as far as could be reached. If the intervertebral foramina were very narrow they have been unroofed by removing sufficient of the intervertebral facets. No attempt has been made in recent years to remove the osseo-cartilaginous bar anterior to the cord, though, in some cases where the emerging nerve has been tightly stretched over an eminence this has been removed, particularly if it has apparently been the cause of root pain. The efficacy of this latter detail is doubtful. In one case a small loose extruded piece of disk cartilage, anterior to the dura mater and surmounting the hard transverse bar, was easily removed, and the result of operation in this patient, whose history was of only six weeks' duration, was highly satisfactory.

After operation all patients have been kept in bed two weeks, and after an extensive laminectomy skull-traction callipers have been applied for that time to maintain the cervical spine in a good neutral position. Thereafter every patient wore a supportive collar, usually of "polythene," for three to twelve months, according to the degree of spondylosis and the extent of the operation. The collar is restrictive rather than immobilizing in its function—to prevent excessive movement rather than to fix the head and neck. Physiotherapy has played its proper part. In three cases spinal fusion has been carried out in conjunction with my orthopaedic colleague, Mr. Osmond-Clarke; in two the result has been highly satisfactory.

As indicated previously (Brain *et al.*, 1952), the choice of cases for operation was at first arbitrary, as its value was unknown. Even now the results are somewhat unpredictable, in that some cases have been relieved to an unexpected degree and in others the results have been disappointing. But operation is undoubtedly advisable as the method of choice in persons under, say, 50, where the lesion is single, and where conservative treatment by immobilization has

failed. In the present series of 39 patients 8 had received conservative treatment for periods up to two years, and in spite of this their condition had worsened; five of these derived benefit from the operation. The results of operation are set out in Table III.

TABLE III.—Results of Operation in 39 Patients

Post-operative death	1
Slowly worsened (3 died of intercurrent disease)	8
Remained stationary (1 died of intercurrent disease)	8
Shown slight improvement (1 died of intercurrent disease)	9
Improved considerably	13

Of those who have derived benefit from the operation none has become entirely normal, though a few have very little disability. Digital dexterity is perhaps the function which recovers least and most slowly. It may be felt that the results are disappointing, and certainly they do not compare favourably—so far as recovery of function is concerned—with the usual experience of the relief of spinal-cord compression due to tumour. But the patients are in no way comparable, for the operation is essentially a palliative one. In many cases, perhaps in all, the damage to the spinal cord is to a greater or less extent ischaemic and the degree of compression unmeasurable. This is perhaps borne out by the cases in which the nervous condition slowly worsens, as happened in eight patients, three of whom died of intercurrent disease. We also do not yet know whether improvement following operation will continue to be maintained: one of the patients who nine years ago derived some benefit from a restricted operation has recently shown deterioration, and a more extensive laminectomy has been carried out. Emphasis must be laid on another aspect: the age of many of the patients is such that reparative powers have already waned. It is probably significant that in the group of 13 patients who improved considerably, only 3 are over the age of 50; thus it includes the bulk of the younger patients.

Summary

Cervical spondylosis may lead to changes in the spinal cord conveniently termed myelopathy, in which compression of the cord by intraspinal osteophytes and ischaemia by interference with its blood supply both play a part to an unknown degree. The results of 39 cases of spondylotic myelopathy treated by operation are reviewed. The duration of the symptoms varied between 6 weeks and 20 years, and the ages of the patients ranged from 30 to 70 years.

Disturbance of function of the cervical spine was insignificant. Weakness or stiffness of one or both legs was the commonest initial symptom—present in 15 cases.

In the upper limbs, weakness, wasting, flaccidity or spasticity, and increase or decrease of tendon reflexes occurred in all but 2 cases. In the lower limbs there was moderate to marked spastic weakness in 27 cases. Sensory disturbances of all varieties occurred in the majority of cases; detection of these, however, may need care.

Disturbances of micturition, rarely severe, occurred in only a minority.

Radiography, including myelography, is essential for diagnosis. Osteophytes may be present at only one level or may be widely distributed, in the latter event producing an extensive cord lesion.

Operation comprised laminectomy, the arch above and below the disk being removed. The ligamenta denticulata have also been divided, and where necessary the intervertebral foramina have been enlarged. In three cases spinal fusion was carried out.

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AETIOLOGICAL FACTORS IN THE PANCREATITIS SYNDROME

BY

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The major obstacle to effective diagnosis and treatment of diseases of the pancreas is the paucity of knowledge of the aetiological factors in pancreatitis. Since the single case reported by Halsted (1901) and Opie (1901), the attention of both clinicians and pathologists has been focused upon the possibility that pancreatitis is the result of impaction of gall-stones in the ampulla of Vater with retrograde flow of bile up the main pancreatic duct. However, many cases of pancreatitis occurring in the absence of cholelithiasis have been reported, and many patients with stones in the common bile duct do not develop pancreatitis. There is, in addition, accumulating evidence of the role of infective, traumatic, and metabolic agents in the genesis of pancreatitis, while the contention of Whipple (1907) that no fundamental distinction can be drawn between acute and chronic pancreatitis has been strongly supported by more recent work (Comfort *et al.*, 1946). It is now certain that "pancreatitis" represents not a disease entity but a syndrome due to pathological processes of differing aetiology affecting the pancreas, relatively few of which are initially inflammatory in nature (Saint and Weiden, 1953).

For these reasons the present paper reports a study of 90 patients with pancreatitis in which special attention has been paid to probable aetiological factors, and presents a tentative aetiological classification of pancreatitis based upon this study. No attempt has been made to discuss fully the clinical features of these patients, for several reviews of the clinical picture of pancreatitis have been published recently, and the present findings agree with these (Comfort *et al.*, 1946; Fallis, 1951; Edmondson *et al.*, 1952; Dolan and Hopkirk, 1953).

In all cases the patients were assessed clinically. Laboratory estimations included repeated estimations of urinary diastase, blood examination, liver-function tests, estimations of serum γ -globulin and total fasting serum lipids (Kunkel *et al.*, 1948). In some patients a glucose-tolerance test, histamine test meal, and gastric biopsy (Wood *et al.*, 1949) were also performed. The biliary tree was examined radiologically by oral cholecystography and later by intravenous choledochography (Hare, 1955), whilst operative cholangiograms were obtained during laparotomy in some instances (Hughes and Kernutt, 1954a; Hughes, 1955). Laparotomy was undertaken in 51, and post-mortem examination was performed in 10 of the 90 patients. The intravenous secretin test was used in some of the first patients studied, but later was discarded as it provided little relevant information not obtainable by other methods.

Diagnostic Criteria

The diagnosis of pancreatitis was considered to be definitely established if one or more of the following criteria were satisfied: (1) Histological evidence of acute or chronic

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