(18), polyradiculitis complicating measles (31), carcinomatous neuropathy (11), tobacco amblyopia (15), transverse myelitis (20), muscular dystrophy (4), lateral sinus thrombosis (24), acute infantile hemiplegia (13), cerebral abscess (20), cerebral contusion (8).

The mean values and standard deviations of gamma-globulin expressed as a percentage of total protein in spinal fluid for 23 patients with multiple sclerosis (acute and chronic) and 177 patients with other neurological complaints are shown in Table II. With a standard error of 1.93, the difference between these means is highly significant ($P \leq 0.001$). The five cases of neurosyphilis had a mean of 27.0, with a standard deviation of 14.71. The remaining 172 cases had a mean of 12.2

TABLE II.—Mean Values and Standard Deviations of Spinal-fluid Gamma-globulin Expressed as a Percentage of Total Protein

	Mean	Standard Deviation
Multiple sclerosis	32.9	± 10.16
Others	12.7	± 7.95

(S.D. ± 7.34). With a standard error of 3.44 the difference between these two means is highly significant ($P < 0.001$). There was no statistically significant difference between the means of the multiple sclerotic and neurosyphilitic cases ($P > 0.2$).

The group of miscellaneous conditions with a mean of 12.7 plus two standard deviations reaches a value of 28.6. Eight of the 177 cases, or 5% of the distribution, lie outside this value, and three of the eight patients making up this proportion gave positive serological tests for neurosyphilis. Of the multiple sclerotic group, 15 of the 23 patients had a higher gamma-globulin fraction than 28.6%.

Discussion

These results indicate that, using the colorimetric method of Papadopoulos, a figure of more than 28.6% of gamma-globulin expressed as a fraction of total spinal-fluid protein is highly suggestive of multiple sclerosis, provided serological tests for neurosyphilis are negative. Levels above 28.6% are found in only about 5% of all other neurological cases, and in a still smaller proportion of those most easily confused clinically with multiple sclerosis, such as subacute combined degeneration, cervical spondylosis, and especially spinal tumour. On the other hand, a "normal" figure (below 28.6%) by no means excludes the diagnosis of multiple sclerosis, such figures being found in one-third of such cases. In this series there was no correlation between gamma-globulin level and duration of symptoms. The Lange curve was "paretic" in only 3 of the 23 cases.

These observations establish that, despite its limitations, estimation of spinal-fluid gamma-globulin can be a useful aid in the recognition of multiple sclerosis, and that at the present time it is the best laboratory test available in this connexion. The colorimetric method yields generally higher levels and a wider scatter than the electrophoretic techniques previously described, but it is simple and rapid enough to permit its employment as a routine laboratory procedure.

Summary

The results of colorimetric estimation of the gamma-globulin content of the spinal fluid in 200 unselected neurological patients are presented and considered in relation to clinical diagnosis. The value of a positive

finding in the differentiation of multiple sclerosis from other neurological disorders is confirmed, and it is suggested that the method is suitable for routine laboratory employment.

We are indebted to Professor A. L. Latner and Dr. Henry Miller for suggesting this investigation and defining its scope and purpose, and to Mrs. D. Weightman, of the Department of Industrial Health, for the statistical analyses.

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Medical Memoranda

An Unusual Injury

A haymaking machine (syn. haykicker. Welsh: chwalwr) designed to throw up and turn cut hay consists of a number of steel prongs which stick out from a bar. A series of bars are attached to a central spindle which rotates as the machine is pulled forward. The bar is about 3 ft. (90 cm.) long (Fig. 1). Older machines, made partly of wood and possessing no guard, were designed to be drawn by a horse. Nowadays they are drawn by tractors and consequently subjected to much greater stress.

Fig. 1.—Photograph of part of haymaking machine.

CASE REPORT

On June 24, 1961, a young fit man aged 18 was driving a tractor hauling such an old type of haymaking machine. Noticing the exhaust of his tractor beginning to turn red, he leaned forward to switch off the engine, when he heard a loud bang and experienced a sudden pain in his back. He was knocked off his seat on to the ground, where he lay in a prone position. He felt a heavy weight on his back and was unable to breathe properly because of pain.

He managed to attract the attention of his sister, who was driving another tractor. She helped him to his feet and walked him over two fields to the farmhouse. From there an ambulance brought him, in the standing position, to the casualty department of the West Wales General Hospital. The situation at the time is shown in Fig. 2. (1) The upper prong of the bar had caused a laceration over the left mastoid and the superficial bony table was fractured. (2) The second prong had entered the chest wall but lay

superficial to the wing of the scapula. (3) The third prong had penetrated more deeply; it was thought that this had penetrated the thoracic cavity.

FIG. 2.—Photograph showing position of steel prongs.

The steel prongs had penetrated some 4 in. (10 cm.) and could not be removed without incision. The entry wounds were tightly fitting around the prongs so that there was no air entry, but it was suspected that this would occur on incision over the lower prong.

The patient was pale and sweating, pulse 120, B.P. 115/70. Chest expansion was shallow but equal on both sides. He was given $\frac{1}{4}$ gr. (16 mg.) of morphine, 2.5 ml. of anti-gas-gangrene serum (A.G.G.S.), and 1,500 units of antitetanus serum (A.T.S.). The splinting arm of the haymaker would make direct laryngoscopy impossible at the time of the induction of anaesthesia. Again, a main meal had been eaten three hours before the accident and tea had been drunk after it. Nevertheless, no further delay in treatment could be contemplated, as he was in great pain and had been standing for three hours.

Operation.—The patient was premedicated with atropine 1/100 gr. (0.65 mg.). Sucker, laryngoscope, and cuffed endotracheal tubes were placed at hand. The operating-table was tipped to its full extent with the patient standing facing it. He was lifted forward on to the table, which was quickly returned to the horizontal; his colour deteriorated immediately. Anaesthesia was induced with 50/50 mixture of nitrous oxide and oxygen and halothane using an open circuit. There was some improvement in colour. Incisions were made over the prongs. As the lower one was extracted there was an audible passage of air into the pleural cavity; the colour of the patient again deteriorated. With digital pressure applied over the wound he was rolled into the left lateral position. Suxamethonium chloride, 50 mg., was injected intravenously and, with suction apparatus ready, the chest was gently inflated with 100% oxygen. A No. 10 cuffed endotracheal tube was inserted, the cuff inflated, and positive-pressure respiration begun. Improvement in colour and pulse was dramatic—the colour remained good; the pulse rate fell to 80 within one minute of intubation. The B.P. was 135/90. A stomach tube was then passed and

the contents were aspirated. The wounds were sutured. A rubber drainage-tube was inserted through a stab wound in the posterior axillary line in the 9th–10th intercostal space. The tube led off to an underwater seal. Anaesthesia was maintained with nitrous oxide, oxygen, and halothane, using intermittent injections of scoline, 25 mg.

After positive pressure had been applied and the drainage-tube clamped the patient's colour was good.

A course of penicillin, 500,000 units six-hourly, and streptomycin, 0.5 g. b.d., was started. His immediate post-operative course was uneventful. The drainage-tube was removed from his chest cavity after 48 hours. Radiographs showed full expansion of lung.

On July 2—that is, one week after his accident—he developed pyrexia of 100° F. (37.8° C.) and a generalized irritable urticarial rash over the arms and legs. This was an allergic reaction to his A.T.S. He was given 50 mg. of promethazine hydrochloride.

Next day he was much worse, with stiffness in all his joints, and in particular his temporo-mandibular joints. The possibility of clinical tetanus was considered, but in view of the urticarial rash and the generalized joint stiffness a severe allergic reaction to A.T.S. was most likely. He was given cortisone, 50 mg. intravenously and 100 mg. orally. This was followed by prednisolone daily in decreasing doses for nine days.

The swellings and stiffness in joints settled quickly with cortisone therapy and had disappeared in four days. He was then allowed out of bed. No further complications occurred and he was discharged home on July 13.

COMMENT

This case illustrates three points. (1) The unusual type of injury: farming is now a form of light industry, bringing in its train many and varied types of injuries. Old machinery should be suspect, particularly when used under more modern conditions of stress. (2) The problems of anaesthesia in a patient with a potential penetrating wound of the chest. (3) Reactions to A.T.S.: Reactions of the type occurring in this patient are not rare. Indeed, some reactions are much more severe and cast doubt on the validity of routine passive immunization.

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The British Red Cross Society has announced that there are now 89 National Red Cross Societies with a membership of 140 million. British Red Cross membership in the United Kingdom and in British territories overseas is 541,588, an increase of 5,388 on last year. Of this number 1,428 have entered some branch of the nursing profession and 17,592 are members of the National Hospital Service Reserve. During 1961 the Society's members undertook nursing duties in 3,304 hospitals, convalescent homes, and clinics, and welfare duties in 2,211 hospitals and convalescent homes in the United Kingdom. There are now 1,607 medical loan depots in the country. The public borrow countless items of equipment for nursing in the home. Members have served at 5,882 blood-donor sessions; 124,334 sick people have been cared for in their homes; 7,218 permanent or temporary first-aid posts have been maintained. (British Red Cross Society, May 4.)