in recent years. As against their opinion must be placed the conclusions of trained observers such as x-ray specialists, clinicians such as Jacquelin, and, least of all, the Auckland records of the War Pensions Appeal Board. I am tempted to believe that the opinion that fibrosis does not occur to any extent following vesicant gas damage has been formed at a stage when the sequelae had not had sufficient time to manifest themselves fully. In recent years the Board has had to adjudicate on a number of cases of death from pneumonia in non-pensioned middle-aged soldiers. Their deliberations would have been greatly assisted by a competent post-mortem investigation.

As regards treatment, the main indication is the avoidance of infection. Pulmonary fibrosis can be subdivided under two headings, wet and dry, according to the sufferers' immunity to catarrhal organisms. As soon as immunity is lost their disability increases enormously, and bronchitis and asthma are much more frequent. The moist coastal climate in the northern areas of New Zealand is not nearly so favourable as the drier inland pumice country. We are fortunate in being able to obtain a reliable stock catarrhal vaccine in Auckland, and in my experience benefit is obtained by its administration, preferably towards the end of the summer.

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THE "CLOVER LEAF" SLING IN PARALYSIS OF THE SERRATUS MAGNUS

BY

H. O. FOUCAR, B.A., M.D.

CHIEF OF SURGERY, ST. JOSEPH'S HOSPITAL, LONDON, ONTARIO

The principle of rest followed by graduated exercise, starting from the zero point and increasing slowly until the muscle moves through its maximum range, has been ably put forth by Mackenzie¹ as the rational form of therapy for paralysed muscles. In the treatment of any paralysed muscle, then, our primary object is to ascertain the position of physiological rest and to maintain it.

ANATOMY

With the need for increased function of the arm as we ascend the animal scale, the scapula loses its connexion with the skull, thus becoming mobile, necessitating a further differentiation and rearrangement of the cervical muscles to control its movement. Complete usefulness of the arm depends not only on the proper function of the muscles inserted into the humerus and acting on the shoulder-joint proper, but also on the muscles arising from the trunk and inserted into the scapula, either stabilizing it or moving it through the acromio-clavicular and the sterno-clavicular articulations. This applies particularly to the ability to raise the arm above the level of the shoulder. To facilitate this the superficial shoulder-girdle muscles—the sternomastoid and the trapezius—have been evolved from the visceral musculature of the gills and from the metameric musculature of the second, third, and fourth cervical segments, while the deeper shoulder-girdle group—the levator scapulae, the two rhomboidei, and the serratus magnus—has been derived from the ventrolateral division of the lower fifth and sixth cervical myotomes. The serratus magnus has moved its point of origin extensively, finally dissociating itself completely from the levator scapulae, but carrying with it its original nerve supply from the cervical region. The other shoulder muscles arise in the blastema of the limb bud, the pectoral group spreading out over the trunk anteriorly and the latissimus dorsi posteriorly, the teres major becoming separated from the latter, to be

attached to the lateral border of the scapula. The deltoid and its offshoot the teres minor, with the supra- and infra-spinati, develop together, while the subscapularis from the first prefers its own company.

The two important muscles controlling the scapula, therefore, are the trapezius and the serratus magnus, and isolated paralyses of these muscles may occur. It is doubtful whether isolated lesions of the two rhomboidei or the levator scapulae are often recognized clinically. The serratus magnus springs from the lateral chest wall and is inserted into the undersurface of the vertebral border of the scapula, and its function is to pull the scapula forwards over the lateral chest wall and also to keep this bone close to the trunk, although Frazer² states that the upper fibres of the latissimus dorsi are responsible for this. The nerve supply is from the fifth, sixth, and seventh cervical roots. This nerve does not enter into the formation of the brachial plexus; thus, in injury to the superior trunk, the serratus magnus may escape, except in avulsion of the cervical roots. Its upper two roots pierce the scalenus medius, while the lower one passes in front of it. They unite as the long thoracic nerve, and pass out of the posterior triangle of the neck on to the outer surface of the serratus magnus behind the axillary vessels and nerves, occupying a position on the inner wall of the axilla and the lateral chest wall.

AETIOLOGY

The signs and symptoms of isolated paralysis of the serratus magnus have been well summarized by Tournay and Kraus.³ The two outstanding signs are the difficulty in raising the arm above a right angle and the undue prominence of the scapula. They tabulate a dozen other minor signs. From the standpoint of aetiology, the patients fall into two groups—toxic and traumatic. In the first group there has been some antecedent or concomitant infection, such as measles, puerperal fever, influenza, or broncho-pneumonia. In the other group the nerve is presumed to have been subjected to injury or pressure in some part of its course. Violent contraction of the scalenus medius, as in swimming or playing tennis, carrying weights causing traction on the shoulder, anomalies of the first rib, enlarged cervical or axillary lymph nodes, and pressure in the axilla have all been incriminated. If the first is a factor one wonders why the rhomboidei are not more often involved, for the posterior scapular nerve also arises from the fifth cervical root and pierces the scalenus medius. The right arm is usually affected. In the two patients under observation this was the case. In the first one, playing tennis may have been the factor, although he also gave a history of having had enlarged cervical glands which had receded completely. In the other case the aetiology was not demonstrable. The patient was a girl 19 years of age, in good general health, giving no history of previous infections. The evidence for trauma was inconclusive. She swam and played tennis moderately, and had suffered no accident. She was a stenographer, using a typewriter and pulling out drawers in a filing cabinet, but there was no evidence of undue exertion. She merely noticed that her arm and shoulder ached, that she was unable to raise her arm above her shoulder, and that her shoulder-blade was prominent. There was no tenderness along the course of the nerve. X-ray examination of the cervical region revealed no abnormalities. Macgregor⁴ suggests the analogy between this condition and facial paralysis of the peripheral type.

The position of physiological rest for the serratus magnus is assumed when the hand of the affected side is carried across the chest and placed on the opposite shoulder. To maintain this position Mackenzie states that the "collar and cuff" sling is satisfactory, and he shows illustrations of good results following its use. It

would seem, however, that the affected shoulder is not sufficiently fixed, but may swing backwards either by gravity when the patient lies down or by the voluntary action of the rhomboidei and the trapezius. To overcome this difficulty H. Houldsworth, orthopaedic technician for Victoria Hospital, designed for the second patient a sling which uses the opposite shoulder as a fixed point, thereby maintaining the serratus magnus at rest at all times (see Figure).

The clover leaf sling, showing the three loops and the fixed point C.

A single strip of $1\frac{1}{4}$ in. webbing five or six feet in length is looped and sewn at the point C, allowing one long end (A) to pass around the neck and a short end (B) to encircle the wrist. At the point C two buckles are sewn in place to receive the ends A and B. The first loop is passed over the shoulder of the unaffected side so that the point C corresponds approximately to the middle of the clavicle. It can be made to measure for the individual, or can be made in quantities (if occasion ever warranted it) merely by allowing a large loop that will slip over any shoulder and then taking a tuck in it to fit the individual. It may be lined with chamois leather. The finished sling consists of three loops, encircling the unaffected shoulder, the neck, and the wrist of the affected side, and maintains a fixed point C. It is light, inexpensive, and efficient. Graduated exercises as outlined by Mackenzie are then commenced. After four months' disability the second patient had improved sufficiently in two weeks of this regime to raise her arm above her head, and since that time her progress has been steady.

Tournay and Kraus make no mention of treatment, but state that the prognosis is not good. That the outlook is not so unfavourable is further borne out by the results in the first patient mentioned above. His paralysis was of three months' duration. He rested his arm for a couple of weeks, and then did not return for fifteen months. In the meantime he continued exercising and now has no functional disability, and his recovery is essentially complete. In long-standing cases contraction of the latissimus dorsi and the pectoralis major may require consideration, for these muscles act as powerful opponents delaying recovery.

SUMMARY

1. The prognosis of isolated paralysis of the serratus magnus is not necessarily unfavourable.
2. The results will be better when Mackenzie's principles are understood and applied.
3. An improved "clover leaf" sling is described which maintains the serratus magnus in the position of physiological rest.

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Memoranda

MEDICAL, SURGICAL, OBSTETRICAL

SPONTANEOUS RUPTURE OF THROMBOSED LATERAL SINUS

Cases which convenience compels me to continue to call "spontaneous" rupture of the wall of a thrombosed lateral sinus with complete recovery are so rare that the following seems worth recording.

HISTORY OF CASE

On May 12th, 1933, a boy, aged 8, was admitted to the York County Hospital. There was a history that six weeks previously he had had measles, and about four weeks before his right ear had discharged. This appeared to have dried up, but on May 11th he was reported to have developed a high temperature, over 104° F., with what seemed to be a rigor.

I saw the patient soon after admission. He was obviously seriously ill, and the soft tissues over the right mastoid were greatly swollen; on operation they were about an inch thick. I opened the mastoid and found an abscess cavity, with the sinus bare in the cavity and apparently covered with granulations. As I suspected thrombosis of the lateral sinus I exposed it further up and down, put a needle into it, and found that it was thrombosed. I opened it up and down, and removed a clot which completely blocked the lumen. I did not tie the jugular. Examination with a probe of that portion of the sinus wall which seemed to be covered with granulations revealed that there was an opening in the wall on the anterior aspect, about an inch in length, into the abscess cavity in the mastoid. I incised the drum membrane.

The child made an uninterrupted recovery, including the regaining of normal hearing, and was discharged with wounds of mastoid and of drum membrane completely healed on June 21st.

The Librarian of the Royal Society of Medicine kindly searched through the literature for me, and found only one record of a similar case. This was reported at a meeting of the Austrian Otological Society in March, 1922, by Ignatius Hofer, and an account of it appears in the *Monatschrift für Ohrenheilkunde* for May, 1922. This case seems to have been almost identical with my own, except that it was operated on at a much later stage and after all general symptoms, including raised temperature, had disappeared, and there was a fistula through the bone under the periosteum of the mastoid, through which pus from a mastoid abscess was issuing. All serious immediate danger to life had apparently been over for some time; rigors had been observed two months before. In my case there was high temperature with rigor the day before I operated. The end-result of both was similar.

Both these cases would appear to show a spontaneous effort of nature to deal with a septic thrombosis of a lateral sinus on the lines on which it is dealt with by operation—namely, by free opening and drainage. In Hofer's case the effort seems to have been well on the way to success when operation was performed. In my case the child was in a bad way, and, but for operation, the issue would have been more than doubtful, though a case is described by G. Charousek in the *Medicinische Klinik* for July 8th, 1927, of a "Spontaneously Healed Otogenic Sinus Thrombosis," in which the thrombosis extended to the jugular, subclavian, axillary, and doubtfully to the ophthalmic veins, and which resulted in complete recovery without other operation than the opening of the mastoid abscess. There is a passing reference to the occurrence of breakdown of the sinus wall in Politzer's and in Ballenger's textbooks, but without description of cases.

York.

PETER MACDONALD, M.D.