Discussion

Broadbent in 1866 was the first to describe a case of herpetic eruption in the course of branches of the brachial plexus followed by partial paralysis in corresponding motor nerves. Since then relatively few cases have been observed, although much interest has been shown in this condition. Taterka and O'Sullivan (1943) reported two cases of zoster with motor complications—one affecting the upper limb and the other the lower. They stated that they had been able to collect from the literature 42 cases of herpes zoster with motor complications. In an analysis of these cases they note that the total number of cases is 44, and that the proportion of males to females is almost 3 to 1. They further state that paralysis of the muscles of the upper extremity occurred in 20 patients, or 45.5% of the cases. The trunk muscles were affected in 18 cases, or 40.9%, and, including their own two patients, there have been only six cases of paralysis of the muscles of the lower limb. They further state that the zoster eruption precedes the paralysis in about three-fourths of the cases and follows it in only one-fourth. The time interval between the eruption of the herpes zoster and the appearance of the paralysis varies from one day to two months. The eruption and the paralysis never appear simultaneously.

In the case under discussion the interval between the appearance of the herpetic eruption and the paralysis was precisely 14 days. Furthermore, there was a history of trauma in this case, but the relation of trauma to the aetiology of herpes zoster is problematic. It occurred in several cases in the literature, but no conclusive result is forthcoming.

The pathogenesis of herpes zoster is not well understood. It is usually stated that there is an inflammatory reaction of the dorsal root ganglia caused by a filterable virus, but how this virus arrives at the dorsal root ganglia is not known. Kinnier Wilson (1940) stated that it travels by the blood stream from the nasopharynx to the spinal ganglia, where it induces tissue reactions and then moves along the sensory nerves to the skin, producing a segmental eruption.

Other observers consider the disease to be an ascending neuritis. As regards the motor complications in herpes zoster it seems logical to assume that this is spread by continuity from the spinal ganglia to the anterior root. Kinnier Wilson, however, denies the existence of lesions of the anterior root and considers a spread of the virus among cell groups of ventral horns more likely.

Herpes zoster has been described as the sensory analogue of poliomyelitis, and the virus of zoster always attacks the sensory system, but the case here described and the other 44 cases mentioned give reason for thinking that the anterior horn cells or motor roots can also be affected. Whether there is any different strain of virus or type of virus that causes these uncommon motor complications can only be conjectured. Several observers have described these motor complications of herpes zoster as acute posterior poliomyelitis, and certainly the clinical findings and cerebrospinal fluid changes support this description.

Summary

A case is described of motor paralysis complicating a herpes zoster, the muscles affected being the quadriceps femoris and the vastus medialis.

The occurrence of this complication in the lower limbs is uncommon, only six previous cases having been reported. The interval between the herpetic eruption and the onset of the paralysis was 14 days.

The distinction of this condition from acute anterior poliomyelitis can be difficult, as the cerebrospinal fluid changes are similar in both diseases, but the paralysis is of more gradual onset in the motor complications of herpes zoster.

I am indebted to Dr. R. H. Quentin Baxter, of Christchurch, for literature and advice on this subject.

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Medical Memorandum

The Pneumatic Balance Valve and its Applications: a Preliminary Report

The pneumatic balance (P.B.) valve is a device for transforming a continuous gas pressure into an intermittent one. A P.B. valve interposed between a low-pressure source of oxygen, controlled by a suitable pressure regulator (demand valve), and a rubber bag will inflate the bag to approximately three-quarters of the pressure to which the demand valve has been set (the line pressure), and then cut off the oxygen and allow the bag to deflate through ports provided for this purpose. When the residual pressure of the gas in the bag has dropped to a predetermined value (say one-tenth of the line pressure) the process is again reversed and the valve continues to cycle so long as the line pressure is maintained.

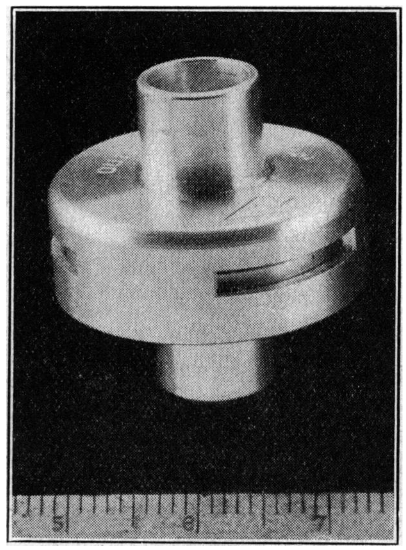
FIG. 1.—The pressure balance valve.

The valve (Fig. 1) consists of a circular metal box, some $2\frac{1}{2}$ in. (6.3 cm.) in diameter, with inlet and outlet connexions. The internal mechanism consists of two diaphragms linked together, which cover valve seatings of different diameters. The smaller valve controls the inlet of fresh gases; the larger valve is on the outlet side of the apparatus, and, owing to its mechanical advantage over the smaller one, to which it is linked, shuts off the flow of gas and opens the expiratory ports when the pressure in the bag reaches three-quarters of that of the demand valve.

Although first described in 1945 in the United States, the P.B. valve does not seem to have received much attention in this country, which is surprising because of its numerous clinical applications, simplicity, small size and outstanding advantages.

The simplest clinical application of the P.B. valve is automatically to inflate the lungs of a subject in need of artificial respiration. Interposition of the P.B. valve between a demand valve, set to deliver oxygen at the desired pressure, and an air-tight face-mask is all that is required.

Since the valve is pressure-operated, the time of cycling (respiratory rate) will depend on the size of the lungs and the pressure applied to the valve. Thus it will be seen to cycle more quickly when applied to a child than when used on an adult. Also, since pressures developed by any attempt on the subject's part to breathe affect the balance of the valve, it will tend to fit its cycling to any respiratory efforts.

It has been stated above that a slight positive pressure remains in the lungs at the end of the expiratory phase of the valve (about one-tenth of the line pressure); this has a certain clinical value, since it may prevent (or cure) any tendency to pulmonary oedema.

The simple apparatus described above, while perfectly satisfactory on the unconscious patient or the patient with complete respiratory paralysis, tends to be resented by the conscious patient and the patient capable of voluntary respiratory effort. Although it is possible voluntarily to stop an inspiration, it is not possible to accelerate it, as the speed at which the valve operates is a function of its design and the gas pressure applied to it. This results in a feeling of suffocation. A more elaborate apparatus (Fig. 2) overcomes this defect by placing a second demand valve in parallel with the first. This second valve is adjusted so that there is no gas flow except during a voluntary inspiration. It is connected to the facepiece through a "Y" connexion, the other limb of the Y being attached to the P.B. valve. In this way automatic artificial respiration is achieved, with the addition of unlimited supplies of gas "on demand" should the patient make a gasping inspiratory effort.

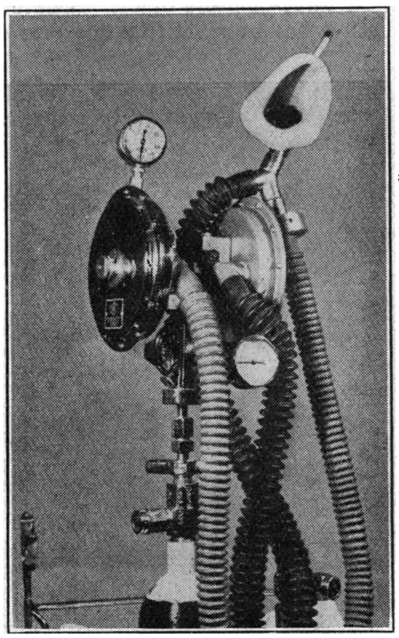

FIG. 2.—Showing two demand valves in parallel. The P.B. valve can be seen just below the face mask on the extreme right.

In anaesthesia, the interposition of a P.B. valve between apparatus of the intermittent-flow type (McKesson) and the patient will give satisfactory controlled respiration. When it is desired to use the valve with the absorption technique it has to be applied indirectly. The bag of the absorber unit is enclosed in a rigid case (Fig. 3), and the P.B. valve controls gas (or air) pressure exerted on the outside of the bag, and in this way causes a rhythmical compression of the breathing bag.

Apart from its application to anaesthetic technique, this valve should prove of great value in cases of poliomyelitis with respiratory paralysis when the patient is

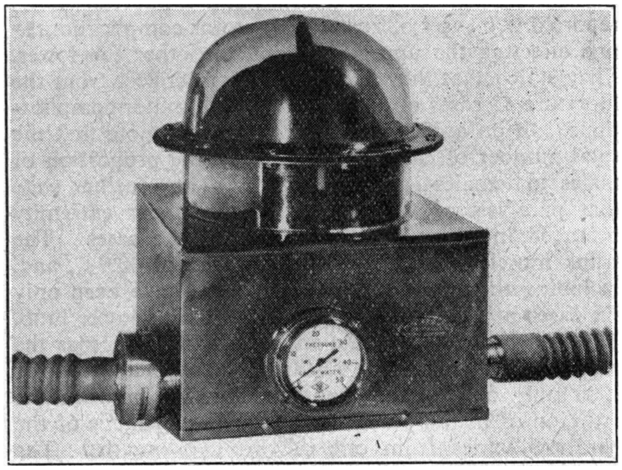

FIG. 3.—Using the P.B. valve indirectly to apply pressure to the outside of a bag attached to an anaesthetic circuit. The P.B. valve is on the left. The tube on the right is attached to the anaesthetic circuit.

removed from the cabinet type of respirator for nursing, etc.; indeed, it has already been used for this purpose in place of manually operated inflators. The latter are not popular with patients owing to inherent defects in hand operation, the difference between one operator and another, and a feeling of suffocation if the control is operated too slowly.

In the field of resuscitation a respirator of the type illustrated has many possibilities. As a therapeutic device for post-operative pulmonary complications and depressed respiratory centres the valve affords a new line of treatment. As a means of obtaining and maintaining controlled respiration in anaesthetics it is most promising.

For experimental work and the development of prototype apparatus in connexion with this valve I am indebted to the unfailing co-operation and enthusiasm of Mr. E. P. Childerhouse, of Medical and Industrial Equipment Ltd., London, W.1.

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