The Serum Treatment of Pneumonia.

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An analysis of 228 consecutive cases of pneumonia treated at the Dunedin Hospital, 1922–23, excluding cases classified as "epidemic influenzal pneumonia." We are indebted to members of the honorary staff for permission to use cases, and to the resident staff for assistance in collecting data.

The following paper was prepared with a view to ascertaining the value to the general practitioner of serum in the treatment of pneumonia:—

The question under discussion, then, is this:—Is the routine use of standard sera justified in the treatment of pneumonia by the general practitioner? Is it worth while?

In this paper technical details of bacteriology will be omitted. The subject will be dealt with from a clinical standpoint. The general practitioner has not the immediate advantage of an up-to-date laboratory, nor has he the time for the specialised work entailed in isolating causative organisms. Special apparatus, skill, and, most important of all, time, are necessary to "type" infections. Meantime the pathological process grows apace.

Our subject will be dealt with under the following headings:—(1) The theory of serum treatment in brief. (2) Technical details of the administration of serum. (3) Immediate complications following the injection of serum. (4) Sequelæ of serum treatment. (5) Statistics. (6) General discussion on cases—(a) The mortality; (b) the development of empyema; (c) general improvement after serum; (d) focal changes in the lung after serum; (e) the production of an early crisis, typical charts, and indications for the repetition of serum; (f) indications for serum treatment. (7) Conclusion.

(1) THE THEORY OF SERUM TREATMENT IN BRIEF.—The idea underlying treatment with serum is contained in the following words:—In order to gain a passive immunity to infection while the body is collecting its forces to repel the attack of invading organisms, we inject into the patient a supply of ready-made weapons. In the first place, in order to obtain these weapons, the horse is injected with varying organisms, the pneumococci and the streptococci; and in due time the horse-serum, containing anti-bodies, reaches the general practitioner.

This serum, then, we may consider as an emergency ration to the patient attacked with pneumonia. With this supply of anti-bodies he can repel the immediate attack of invading organisms, his body in the meantime forming an active immunity to the disease.

During our investigation we shall hope to find answers to these questions: Does serum act as an emergency ration? Does it stay the onslaught of pneumococci until bodily defence is sufficient to cope with it?

(2) TECHNICAL DETAILS IN THE ADMINISTRATION OF SERUM.—(a) Sera used. (b) Dosage. (c) Methods and routes of introduction.

(a) *Sera Used.*—The Commonwealth Serum Laboratory sera were used exclusively in this series of cases: Antipneumococcal (polyvalent); antipneumoccal (monovalent, against Type 1); antistreptococcal (polyvalent). Speaking generally, antipneumococcal sera were used in lobar pneumonia, while, later in our experience, antistreptococcal serum was combined with antipneumococcal serum in cases of broncho-pneumonia, especially that following whooping-cough.

(b) *Dosage.*—This was dependent upon the route chosen and the age of the patient. The customary doses aimed at were as follows:—Intravenous—Adults, 60-120c.c.; children, 30-60c.c. Intramuscular—Children, 30-60c.c. Subcutaneous—Children, 60-90c.c. If the case showed improvement in 12 hours, and if improvement was not sustained, serum was repeated according to the indications present. These indications will be discussed later.

(c) *Methods and Routes of Introduction of Serum.*—(1) The intramuscular route and (2) the subcutaneous route (in children). (3) *Via* the superior longitudinal sinus in babies. (4) Intravenous route.

(1) The Intramuscular Route.—The site most commonly chosen is the buttock. In babies and in children where the veins are not prominent, or

where the child is fractious, this method is used. A sterile 20c.c. syringe is filled with serum, air-bubbles being excluded, and the needle plunged *boldly* into the prepared skin over the buttock. Usually the child does not mind the bold, sudden stab of a sharp needle. Most inconvenience arises when the tension in the buttock following the injection of serum becomes too high. Massage of the "serum tumour" soon disperses the liquid into intramuscular spaces. Thirty c.c. into each buttock for a child of three years is sufficient. Generally there is no local reaction. Occasionally a red flush appears over the buttock. We have observed no systemic reaction. No local abscess occurred.

(2) The Subcutaneous Route.—This method was after a time considered unsatisfactory. Sites chosen were pectoral or inguinal. As much as 30c.c. may be injected into the fold of the groin in a child of three years without severe pain, provided the thigh be flexed.

(3) Via the Superior Longitudinal Sinus (intravenous).—This method suggested itself, but we considered the danger of intra-cerebral injury too great to balance any advantage which serum might have given to the patient.

(4) The Intravenous Route.—The results of using this method justify our conclusion that it is preferable. Most of our cases were treated thus:—

(a) A preliminary injection of atropine sulphate is given hypodermically fifteen minutes before the operation. In an adult 1/100gr. is the usual dose. This injection is important.

(b) Choice of Vein, etc.—A vein in the antecubital region at the elbow is usually chosen. The forearm is then prepared with iodine and spirit, the latter an advantage in children where the veins are not prominent. A tourniquet is then placed round the arm sufficiently tight to engorge the veins below.

(c) A Local Anæsthetic is then given.—This we consider an important detail. From a humane as well as from a practical point of view local anæsthesia is an advantage. The physician should remember that a second dose of serum is not infrequent. A tiny spot of pure carbolic acid is placed on the skin half an inch lateral to the vein selected. Apothesin and adrenalin, 1 per cent., or novocain, ½ per cent., is then injected through the carbolised area intradermally. Sufficient is injected to cause a wheal the size of threepence. A larger needle may then be used.

(d) Approaching the Vein.—We are accustomed to approach the vein from its lateral aspect for two reasons. Firstly, a local anæsthetic over a vein may cause, occasionally, local spasm of the vessel. Secondly, a needle advancing on the lateral aspect of a vein may be seen to kink the vein as it strikes its lateral surface, and thus some indication of proximity of lumen of vein and needle is obtained. In children of tender years and in stout females a warm bath for a few seconds, or tapping the vein with the forefinger, may cause the vein to dilate; also it may be noted that a large vein at the elbow may be palpated even if it be not seen.

(e) The Injection of Serum.—As soon as blood appears in the syringe, sufficient is drawn off for blood culture and the tourniquet is released. The needle is then steadied with the left forefinger and thumb, while the syringe is detached with the right hand. The syringe is then filled with serum, and, air-bubbles being excluded, the syringe is connected to the needle. A little blood may mix with the serum, the mixture being slowly injected into the vein. The syringe may be refilled as required, the needle remaining in the vein. During the injection the patient may complain of pain, this pain varying in significance. Pain during the injection of serum is discussed under our next heading.