

arm is bandaged over the highest point of the shoulder and under the axillary piece, and then down the arm and forearm. In dressing the case it is only the latter bandage that is removed; the bandage fixing the thoracic piece to the chest keeps the splint in position while the dressing is carried out. Extra security can be obtained by passing a triangular bandage under the axillary piece and tying over the shoulder of the opposite side, as shown in Fig. 5.

I have now used this splint on 12 cases and have found it very satisfactory. It is easily applied while the patient is under the anæsthetic, and takes about 15 to 20 minutes to complete. By making each splint at the time of operation the individual requirements of a particular case are catered for. After the operation the patient is quite comfortable, rigidity is adequate, and subsequent dressings are much facilitated.

PERSISTENCE OF ANTIBODIES IN THE BLOOD OF INOCULATED PERSONS AS ESTIMATED BY AGGLUTINATION TESTS.¹

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(From the Laboratory of the British Red Cross Hospital No. 4: Sir HENRY NORMAN'S.)

In the course of work carried out recently in the British Red Cross Hospital No. 4 by the kind invitation of Sir Henry Norman, Bart., M.P., to whose hospitality we were entirely indebted, and who fitted up a laboratory expressly for the purpose, we investigated the agglutinin content of the blood in a number of normal inoculated persons. Our work was facilitated, and in fact only made possible, by the kindness of Colonel Sir William Leishman, F.R.S., and Lieutenant-Colonel Evans, C.O., 14th Stationary Hospital, who with his staff generously placed at our disposal the extensive material at their command.

All the normal individuals examined (officers and privates, nurses, and Red Cross orderlies) had received one or two doses of army typhoid vaccine within the period from August, 1914, to the end of March, 1915. The agglutination tests were carried out in the course of the last ten days of April. The method employed was that already fully described elsewhere by one of us (G.D.^{2 3}), and the use of standardised agglutinable cultures rendered the results obtained entirely comparable.

To facilitate the survey of these results they are arranged in the accompanying table in four groups:—

Group I. contains persons *not* previously inoculated, who received two doses of vaccine with an interval of about ten days between the doses.

Group II. contains the persons who had previously been inoculated (within the preceding six years), and who on this occasion received two doses of vaccine with an interval of about ten days between the doses.

Group III. comprises persons not previously inoculated who received only a single dose of vaccine.

Group IV. consists of persons previously inoculated (within the last six years) who received on this occasion only a single dose of vaccine.

The table gives all essential details. Two different standard agglutinable cultures were used in the course of the work, and the final results are stated in terms of the standard agglutinin unit.

Results of Agglutination Tests.

Number.	Reference number.	Date of inoculation.	Serum dilution 1 in —	Standard agglutinin units per c.c. of serum.	Number.	Reference number.	Date of inoculation.	Serum dilution 1 in —	Standard agglutinin units per c.c. of serum.
Group I.					39	30	Dec., 1914.	750	139
1	1	Sept., 1914.	375	150	40	44a	"	190	76
2	2	"	375	70	41	37	"	375	70
3	3	Oct., 1914.	7500	1390	42	31	"	360	67
4	7	"	1875	750	43	32	"	360	67
5	8	"	875	350	44	27	"	150	60
6	6	"	1875	348	45	28	"	90	36
7	5	"	700	130	46	48	Jan., 1915.	875	162
8	4	"	375	70	47	49	"	190	76
9	20	Nov., 1914.	3125	580	48	47	"	330	61
10	21	"	3125	580	49	46	"	320	59
11	12	"	750	300	50	50	"	90	36
12	26	"	750	300	51	45	"	190	35
13	25	"	1500	278	52	51	Feb., 1915.	750	300
14	22	"	875	162	53	52	"	190	76
15	9	"	375	150	54	53	"	150	60
16	15	"	750	139	55	55	March, 1915.	3750	1500
17	17	"	750	139	56	54	"	1500	278
18	24	"	730	135	Group II.				
19	14	"	330	61	57	56	Nov., 1914.	1875	348
20	16	"	330	61	58	57	"	750	139
21	23	"	330	61	59	59	"	750	139
22	13	"	320	59	60	60	"	700	130
23	11	"	90	36	61	58	"	330	61
24	18	"	90	35	62	61	Jan., 1915.	330	132
25	19	"	190	35	Group III.				
26	10	"	75	30	63	65	Sept., 1914.	140	56
27	43	Dec., 1914.	7500	1390	64	62	"	90	36
28	42	"	3125	580	65	63	"	90	36
29	44	"	1500	278	66	64	"	90	36
30	41	"	1500	278	67	66	Oct., 1914.	190	76
31	36	"	1500	278	68	68	Feb., 1915.	375	150
32	34	"	1500	278	69	67	"	150	60
33	38	"	875	162	70	70	March, 1915	3125	1250
34	39	"	750	139	71	69	"	1500	600
35	40	"	750	139	Group IV.				
36	35	"	750	139	72	71	Aug., 1914.	1500	600
37	33	"	750	139	73	72	"	750	300
38	29	"	750	139	74	73	"	75	30

The importance of the latter method of expressing results is well brought out in the present series of observations, since with different standard agglutinable cultures agglutination in the same serum dilution does not necessarily imply the presence of the same number of standard agglutinin units in the serum. For owing to the different agglutinability of different cultures each standard agglutinable culture has its own particular reduction factor for calculating the number of standard agglutinin units in any given serum tested. This unit was

¹ The expenses of this work have been defrayed out of a grant received from the National Medical Research Committee.

² Dreyer, Georges: *Widal's Reaction with Sterilised Cultures*, Hospitalstidende, No. 19, 1906, and *Journal of Pathology and Bacteriology*, vol. xiii., 1909.

³ Dreyer, Georges; Walker, E. W. Ainley; and Gibson, A. G.: *Typhoid and Paratyphoid Infection in Relation to Antityphoid Inoculation*, THE LANCET, Feb. 13th, 1915.

originally fixed arbitrarily as the amount of agglutinating serum which, when made up to 1 c.c. volume with normal saline solution, caused standard agglutination on being mixed with 1.5 c.c. of a particular (original) standard agglutinable culture and maintained at 55° C. for two hours in a water-bath followed by 15 minutes at the room temperature.

Standard agglutination is the highest dilution in which a given serum causes marked agglutination (without sedimentation) visible to the naked eye. And it follows from what has just been said that if standard agglutination occurs in a serum dilution of 1 in 1000, say, then 1000 divided by the reduction factor for the particular standard agglutinable culture employed gives the number of standard agglutinin units per c.c. of the serum. For the two standard agglutinable cultures used in these experiments the reduction factors were 2.5 and 5.4 respectively.

The points which we wish to bring out from the table are the following:—

1. For at least eight months after a single or double dose of typhoid vaccine the serum of every inoculated person contained relatively large quantities of antibodies—viz., agglutinins.

2. The maximum content of agglutinin per c.c. of serum found in any inoculated person was 1500 standard agglutinin units; and no inoculated person showed less than 30 units per c.c. of his serum. On the other hand, it may be mentioned that in no case of 30 persons examined at different times and places has the serum of non-inoculated individuals, who had not had typhoid fever, ever exhibited an agglutinin content reaching 10 units per c.c. of serum.

3. Just over half the persons examined between four and six months after inoculation showed an agglutinin content of 130 units or more per c.c. of serum.

4. Persons who received two doses of vaccine usually, but not always, exhibited a higher agglutinin titre than those who had only one dose.

5. Although the titre of the serum in persons who had not been inoculated before, and only received a single dose of vaccine, may in some instances at first be as high as or even higher than that of those who received two doses, it was found that after a certain lapse of time it falls to a lower level than in the latter individuals. This point is of interest and corresponds exactly to what one found to be the case in comparing the agglutinin curves of persons who had suffered from relapse in typhoid fever with those in which no relapse had taken place. In the former the agglutinin titre remained for a long period at a higher level than in the latter.

6. In persons who had been inoculated before (within six years) the agglutinin titre maintained a high level for a longer period than in the case of those not previously inoculated.

7. The importance of repeated inoculation is therefore clearly not so much that it induces of necessity a higher initial immunity, but that it ensures with certainty a more persistent one. This is seen at once on comparing Group IV. with Group I.

8. If the individual observations in the different groups be divided into sub-groups according to the length of time since inoculation, and the figures averaged for each sub-group, it can be seen that the gradual fall in agglutinin titre which occurs as

time elapses can be plotted in a curve. This curve is closely similar to the ordinary agglutinin curve of an inoculated experimental animal.

In investigating the material then available Leishman⁴ came to the conclusion (1914) that after a double dose of typhoid vaccine an increased resistance to infection for a period up to 18 months or two years could be proved statistically. This conclusion is fully borne out by the results we have obtained. Our results show further that the persistence of agglutinins in the blood endures for much longer periods than has usually been recognised.

THE VALUE OF TURPENTINE AS A HÆMOSTATIC.

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I HAVE been led to add my testimony to this matter by the timely note on "The Therapeutic Uses of Turpentine" published in a recent number of THE LANCET.

My attention was first drawn to the subject by a story which I heard in my student days. A young and enthusiastic surgeon unwittingly excised the elbow-joint in a "bleeder." The hæmorrhage was severe and long-continued, and resisted all efforts to control it. When the patient was at death's door and the surgeon driven to distraction a friendly colleague offered to take charge of the case. The wound was packed with gauze soaked in turpentine, and from that time onwards there was no further hæmorrhage. This story has stood me in good stead, for on many occasions I have proved the efficacy of the same remedy. But it is essential that it should be properly used, and of this I had a recent striking example:—

A boy aged 8, the subject of hæmophilia, was admitted to the wards with which I am associated. All ordinary means had failed to staunch severe and persistent hæmorrhage from a small wound of the palm, and I gave directions that turpentine should be used. Next day I was informed that the bleeding had not ceased. On investigating the matter I found that a piece of gauze had simply been soaked in turpentine and laid over the wound like an ordinary dressing. The only result was a rather extensive blister. As the condition of the boy was alarming and the bleeding still continued I made a graduated compress of lint soaked in turpentine and squeezed nearly dry. This was supported by a pad of wood-wool and with a firm bandage fixed in position and not disturbed for several days, with the result that there was no further hæmorrhage and no trouble from the blister.

The principal sphere of turpentine as a hæmostatic is in cases of secondary hæmorrhage, and there can be no better illustrations than the sort of cases met with in the general hospitals of this country as the result of the war. It has several times been successful when it looked as though the ligature of one of the main vessels of a limb in continuity or even amputation would be called for. A recent example illustrates this very well:—

Private K. of the 1st Coldstreams was wounded in France, a bullet passing through the front of the right leg and finding an exit just above and behind the external malleolus. He was admitted to the 1st Northern General Hospital six days later. He was then anæmic and ill, with a temperature of 101° F. and a quick, small pulse. The wounds of entrance and exit were small, but the whole of the limb was much swollen and greatly discoloured, while some thin, brownish, foul-smelling

⁴ Colonel Sir William Leishman: Antityphoid Inoculation, *Journal of the Royal Army Medical Corps*, vol. xxii., 1914.