

THE VALUE OF THE DICK TEST IN PREGNANCY.*

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DURING the year 1929 an investigation was conducted, at the Glasgow Royal Maternity and Women's Hospital, into the value of the Dick test (*i.e.* the cutaneous reaction to the intradermal injection of scarlatinal streptococcic toxin) as an index of susceptibility to puerperal sepsis. Because of the generally accepted view that the toxins produced by the scarlatinal and puerperal hæmolytic streptococci are identical, it was thought possible that sensitiveness to the one might indicate a similar degree of susceptibility to the other and, if this were so, that the test might be of value in the prophylaxis of puerperal sepsis.

The Dick test was performed in a series of 600 pregnant women, either during labour or in the last few weeks of pregnancy. Careful histories were taken on cards specially designed for the investigation, particular note being made of previous streptococcal infection—*e.g.* scarlet fever, tonsillitis, puerperal sepsis, of the obstetric history and of the health during the current pregnancy. Full particulars were subsequently obtained regarding the mode of delivery, presence of lacerations, and the puerperium in 500 of these cases. Where the puerperium was morbid, even although not notifiable according to the B.M.A. standard, it was classed as puerperal sepsis, care being taken to eliminate those cases of pyrexia due to other causes, such as urinary infection. A number of cases with a positive Dick test who developed pyrexia in the puerperium were retested immediately after the pyrexial period to see if any change in the reaction had occurred. Some of these were again tested six months later.

Method.—The toxin used was the standardised product in use for the Dick test in scarlet fever, and was kindly supplied by Dr R. A. O'Brien of the Wellcome Physiological Research Laboratories. Two different dilutions of toxin were used, 1/250 and 1/1000, 0.2 c.c. of each being injected intradermally on the flexor aspect of the left forearm about 3 inches apart. On the other arm an injection of 0.2 c.c. of heated toxin was

* Read 14th May 1930.

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given to act as a control. A positive result was indicated by an area of redness, at least 10 mm. in diameter, appearing within twenty-four hours. The extent of the erythema was measured in two diameters, and in the subsequent analysis 1+ represents 10-20 mm., 2+ 20-30 mm., and so on. In none of the cases with a positive reaction was there any appreciable reaction in the control.

In order to determine the optimum dilution of toxin, an analysis was made of the first 200 cases in whom the two strengths of toxin, 1/250 and 1/1000, were used. Of these, only 16 or 8 per cent. were positive with 1/1000 dilution, whereas 43 or 21.5 per cent. were positive with 1/250 dilution. Of 21 cases in whom the 1/250 dilution gave a 1+ reaction, only 1 was positive with the 1/1000 dilution. In 9 cases the 1/250 dilution gave a 2+ reaction, and in only 2 of these was the reaction positive with 1/1000 dilution—in each case 1+. In all the cases where the 1/250 dilution gave a reaction over 2+ there was a reaction with the 1/1000 dilution, but to a smaller extent. The deductions which follow have therefore been based on the results obtained with the 1/250 dilution of toxin, for two reasons: (1) too small a proportion of the women gave a positive reaction with the weaker dilution; and (2) by measuring the extent of the reaction with the stronger dilution (1/250) some idea of the *degree* of susceptibility to streptococcic toxin was got.

The Relation of the Dick Test to Age and Parity.—600 cases have been tested. Of these, 135 or 22.5 per cent. had positive reactions, 44 or 25 per cent. out of the 179 primiparæ in the series and 91 or 21.5 per cent. out of the 421 multiparæ. There is therefore a slightly higher percentage of positive reactors among primiparæ than among multiparæ. The impression formed while doing the tests was that the reaction tended to be more marked in primiparæ, and this was borne out by the figures. Table IA shows that 39 per cent. of the primiparæ and only 17 per cent. of the multiparæ gave a reaction of 3+ or over.

It was thought that, like scarlet fever and other infectious diseases, susceptibility may decrease with advancing years, and to investigate this point the patients were divided into the following age-groups: 15-25, 26-35, and 36-45. It was found that younger women did not show a larger percentage of Dick positive results than older women, whether primiparæ or

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multiparæ. Actually the percentage of positive reactions was greater in the second age-group.

The Effect of Multiparity and Age on Incidence and Intensity of Dick Reaction.

TABLE IA.

	Total.	1 and 2+.	3+ and over.
Primiparæ	44	61 per cent.	39 per cent.
Multiparæ	91	83 "	17 "

TABLE IB.

15-25	38	21 = 55 per cent.	17 = 45 per cent.
26-35	77	63 = 81.8 "	14 = 18.2 "
36-45	20	18 = 90 "	2 = 10 "

Whether the age or the parity of the patient is the more important factor in influencing the intensity of the reaction was the next point to be considered. Table IB shows that there was a bigger proportion (45 per cent.) of strong reactors over 2+ in the first age-group than in the second (18.2 per cent.), but it was noted in Table IA that primiparæ tended to give more intense reactions than multiparæ, which would explain the large proportion of specially susceptible cases in the first age-group. In the last column of Table II it is seen that in

TABLE II.

The Incidence and Intensity of the Dick Reaction in Primiparæ and Multiparæ in the Various Age-groups.

Age-groups.	Primiparæ.	1 and 2+.	3+ or over.	Multiparæ.	1 and 2+.	3+ or over.
15-25	108	13 = 12 per cent.	11 = 10.2 per cent.	89	8 = 9 per cent.	6 = 6.6 per cent.
26-35	64	11 = 17.5 per cent.	7 = 10.9 per cent.	236	52 = 22 per cent.	7 = 3 per cent.
36-45	7	2	0	96	16 = 16.6 per cent.	2 = 2 per cent.
...	179	421

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multiparæ the percentage of strong reactors diminished steadily from the youngest to the oldest age-group, whereas the primiparæ showed no fall in the percentage of strong reactors in the older age-group. These figures therefore indicate that the decrease in sensitivity which occurs with advancing years is really due to increased parity, which in the hospital class of patient is, all too frequently, directly proportional to age.

If susceptibility to scarlatinal streptococcic toxin is an indication of susceptibility to puerperal sepsis, one would expect from the previous analysis to find more sepsis among primiparæ than among multiparæ. To investigate this point 225 of our cases in whom the health was good and the delivery quite normal have been analysed. One must bear in mind that in primiparæ spontaneous deliveries which are recorded as being free from lacerations will be accompanied by more unnoticed bruising than spontaneous deliveries in multiparæ—this fact in itself might tend to increase the sepsis rate among primiparæ. It was found that the sepsis rate (26 per cent.)* in primiparæ for the first two age-groups was the same, whereas in multiparæ it was 11, 7, and 6 per cent. in the three age-groups respectively. The correspondence between these figures and those recorded above from a similar analysis of the intensity of the reaction to the Dick test might suggest that there exists some relationship between sensitiveness to streptococcic toxin and a liability to puerperal sepsis. To investigate this question further, there were 25 cases followed throughout the puerperium in whom the Dick reaction was 3+ or over. There was no sepsis in 17 of them where the health was good and the delivery normal, no sepsis in 7 where there were predisposing factors, either ill-health or difficult delivery, and 1 died, probably of sepsis, who had both ill-health and difficult delivery. It is not possible to conclude from such a small number of cases whether or not a high degree of susceptibility to Dick toxin indicates a similar degree of susceptibility to puerperal sepsis.

The Relation of the Dick Test to previous Streptococcal Infection.—Susceptibility to scarlatinal streptococcic toxin does not appear to be influenced by previous streptococcal infection if the histories obtainable from this class of patient be accepted. The percentage of positive reactors was the same in patients giving a history of scarlet fever or repeated attacks of tonsillitis

* This high figure is explained by the fact that even the slightest degrees of sepsis are included.

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as in those who gave no such history, 23 per cent. in the former group and 22 per cent. in the latter. As regards puerperal sepsis, it must be borne in mind that only the more severe infections would be recognised as such by the patients. Histories of undoubted puerperal sepsis were obtained in 26 cases, of whom 5 (19 per cent.) were Dick positive. Only 1 out of 23 of these cases whose puerperia were observed developed puerperal sepsis in the present instance. The deduction may be made from these findings that the immunity, at least the antitoxic immunity, resulting from streptococcal infections is only temporary or incomplete. Whether a previous puerperal infection with hæmolytic streptococci confers an antibacterial immunity must be left undecided.

The Relation of the Dick Test to Puerperal Sepsis.—500 cases have been followed throughout the puerperium to see if there was any relationship between a positive reaction to the Dick test and the occurrence of puerperal sepsis. 106 or 21.2 per cent. gave a positive reaction and 394 or 78.8 per cent. gave a negative reaction. Of the positive cases, 12.2 per cent. had morbid puerperia according to the B.M.A. standard; and of the negative cases, 9.4 per cent., agreeing roughly with the figures of others who have analysed their results thus. However we thought it advisable to make a further analysis of all cases showing any sign of sepsis, whether notifiable or not, as cases of undoubted sepsis do occur with very little temperature, *e.g.* white leg and pelvic cellulitis. The details of this analysis can be seen in Table III. When all cases with a febrile puerperium were divided into two sections according to whether they were Dick positive or Dick negative, almost as big a proportion of Dick negative cases had morbid puerperia as Dick positive cases. The two sections were further subdivided to differentiate between notifiable and non-notifiable cases, and it was found that there was a slightly higher percentage of notifiable cases in the Dick positive group. Some of the notifiable cases are not puerperal sepsis, but urinary infections, chest conditions, and mastitis due to staphylococcus aureus, so that notifiable cases in each group were again subdivided into true puerperal sepsis and pyrexia due to other causes. It was then found that there was a bigger proportion of notifiable puerperal sepsis in the Dick positive group and, conversely, a greater incidence of non-notifiable puerperal sepsis in the Dick negative group. To simplify matters the

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cases of true puerperal sepsis have been expressed as percentages of the total Dick positive and Dick negative cases (figures at the foot of Table III). 8 or 7.5 per cent. of the 106 Dick positive cases developed notifiable puerperal sepsis and 6 or 5.6 per cent. developed non-notifiable puerperal sepsis, a total of 13.1 per cent. 21 or 5.3 per cent. of 394 Dick negative cases developed notifiable puerperal sepsis and 38 or 9.6 per cent. developed non-notifiable puerperal sepsis, a total of 14.9 per cent. While the percentage of true puerperal sepsis was slightly lower in the Dick positive group than in the Dick negative,

TABLE III.
Showing an Analysis of the Morbid Cases.

Morbid puerperia 141 cases							
Dick +ve 32 or 30% of total Dick +ve cases				Dick -ve 111 or 28% of total Dick -ve cases			
Notifiable 13 or 40.6% of the morbid Dick +ve cases		Non-notifiable 19 or 59.4%		Notifiable 39 or 35% of the morbid Dick -ve cases		Non-notifiable 72 or 65%	
P.S.	O.C.	P.S.	O.C.	P.S.	O.C.	P.S.	O.C.
8 or 61.5% of the notifiable Dick +ve cases	5 or 38.5%	6 or 31.6% of the non-notifiable Dick +ve cases	13 or 68.4%	21 or 54% of the notifiable Dick -ve cases	18 or 46%	38 or 52.7% of the non-notifiable Dick -ve cases	34 or 47.3%
7.5%		5.6%		5.3%		9.6%	
P.S. = Puerperal sepsis.				O.C. = Other causes.			

13.1 as compared with 14.9 per cent., yet as all the most severe cases were in the notifiable group, the percentage of severe sepsis is rather greater in the Dick positive group—7.5 as compared with 5.3 in the Dick negative. Therefore it would seem that women who were Dick positive were no more liable to puerperal sepsis than Dick negative women, but that if infection did occur it tended to be of a more severe type in Dick positive cases. This was borne out by comparison of the actual notifiable cases in both Dick positive and Dick negative groups—3 out of 8 Dick positive cases died of puerperal sepsis and only 4 out of 21 Dick negative, one of the latter deaths being due to peritonitis caused by leakage from an infected

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fibroid. Of the cases of puerperal septicaemia who recovered, 2 were Dick positive and 4 were Dick negative. 7 out of 8 or 87 per cent. of the Dick positive notifiable cases were suffering from severe sepsis as compared with 10 out of 21 or 47 per cent. of the Dick negative notifiable cases (see Table IV). In such a small series factors such as the general condition of the patient and the type of delivery, which might predispose to sepsis, may affect these figures. On analysis these factors were found to be approximately equal in both Dick positive and Dick negative groups and could therefore be ignored in the analysis.

TABLE IV.

Showing details of the Cases who developed notifiable Puerperal Sepsis.

8 Dick +ve Cases.	21 Dick -ve Cases.
Acute sepsis with—	Acute sepsis with—
Peritonitis—death . . . 3	Peritonitis—death . . . 2
Septicaemia—recovered . . . 2	Cellulitis-embolism—death . . . 1
Parametritis . . . 2	Infection of fibroid—death . . . 1
Severe local sepsis . . . 1	Septicaemia, severe—recovered . . . 4
	Parametritis—recovered . . . 2
	White leg . . . 1
	Abdominal abscess after C.S. . . 1
	Local sepsis . . . 9

Incidence of Puerperal Morbidity in relation to Ill-health and Difficult Labour.—The relative importance of the reaction to the Dick test, the general health of the patient, and the type of delivery as factors in the production of puerperal sepsis is indicated in Table V. The figures emphasise the fact that a difficult delivery was the most important single factor and bad general health the next: when both these factors were present 70 per cent. of the women had morbid puerperia. A positive reaction to the Dick test was the least important predisposing factor. This was further emphasised by the fact that although in 500 cases which included all sorts of obstetric complications the notifiable sepsis rate was 12·8 per cent., yet if only those women with good health and normal delivery (225 cases) be considered, only 4 or 1·7 per cent. had notifiable sepsis—all of whom had perineal tears requiring several silkworm sutures. 2 of these were Dick positive and 2 Dick negative. The rate of notifiable sepsis for the remainder of the 500 cases was 22 per cent.

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TABLE V.

Showing the Relative Importance of the Reaction to the Dick Test, Bad General Health, and Difficult Delivery in Puerperal Sepsis.

Factors Present.	Dick +ve.	Dick -ve.
Good health and normal delivery .	Afebrile . . . 47 Febrile . . . 6 or 11.3 per cent.	Afebrile . . . 237 Febrile . . . 22 or 8.5 per cent.
Bad health only	Afebrile . . . 11 Febrile . . . 2 or 15.4 per cent.	Afebrile . . . 24 Febrile . . . 9 or 27.5 per cent.
Difficult delivery only	Afebrile . . . 23 Febrile . . . 8 or 34.7 per cent.	Afebrile . . . 37 Febrile . . . 43 or 54 per cent.
Bad health and difficult delivery .	Afebrile . . . 2 Febrile . . . 7 or 77 per cent.	Afebrile . . . 7 Febrile . . . 17 or 70 per cent.

The Reaction to the Dick Test after Puerperal Sepsis.—

21 women who had given a positive reaction to the Dick test were re-tested in the puerperium: 13 of them remained positive, only 2 of whom had pyrexia in the puerperium, and this in both was due to a urinary infection with a coliform organism. In these the intensity of the reaction also remained unaltered. In the remaining 8 cases there was sepsis, slight in 6 and severe in 2, and in all of these the reaction to the Dick test became negative. An attempt was made to re-test all of these patients six months later, but unfortunately only 3 of those who had become Dick negative in the puerperium could be traced. 1 was again Dick positive, the other 2 remaining Dick negative. All the cases who had remained Dick positive after delivery were still positive.

Discussion.—Since this investigation was begun several papers have appeared on the subject. Burt-White and Colebrook gave their results for 1000 cases investigated in the London Maternity and Queen Charlotte's Hospitals. They suggest that women with a Dick positive reaction have an increased susceptibility to puerperal sepsis, since in their series the morbidity amongst Dick positive cases was 41 per cent. greater than in the Dick negative group. In the morbid cases cervical swabs were taken, but in only 8 of these was the streptococcus pyogenes isolated—in 2 out of 770 Dick negative cases or 0.26 per cent., and in 6 out of

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230 Dick positive cases or 2.6 per cent. They therefore state that the incidence of streptococcus pyogenes infection in the puerperium is ten times greater in Dick positive than in Dick negative cases. However the fact that hæmolytic streptococci were not isolated from the cervical swabs does not prove conclusively that the streptococcus is not the infecting organism. It is interesting to note in our series that when Dick positive cases who had sepsis, however slight, were re-tested after the pyrexia subsided the Dick reaction became negative, but remained positive in those who had a coliform urinary infection. The incidence, in Burt-White and Colebrook's series, of only 1 case where a few colonies of streptococcus pyogenes were isolated, out of 38 Dick negative cases with morbid puerperia, is at variance with our findings, where 10 or 47 per cent. out of 21 Dick negative women with notifiable puerperal sepsis had such a severe type of infection as almost certainly to be due to the hæmolytic streptococcus.

To sum up, we have found that 22 per cent. of pregnant women gave a positive reaction to the Dick test, primiparæ giving a slightly higher rate than multiparæ—25 per cent. as compared with 21.5 per cent. The reaction seems to be more intense in primiparæ, irrespective of age, than in multiparæ. In the latter there is a decrease in the intensity of the reaction in the older age-groups, which might indicate that with each pregnancy the patient has a chance, by repeated slight infection, of becoming more immune. The incidence of puerperal morbidity also becomes less with advancing years in multiparæ but remains constant for all ages in primiparæ.

The incidence of puerperal sepsis is so dependent on the general health of the patient, and upon the type of delivery, that any reliance on the Dick test as an indication of liability to sepsis would not be justifiable. It appears to us, however, that in the present state of obstetric practice an attempt to produce a temporary immunity with a concentrated anti-scarlet serum in all suspect cases at the time of delivery might reduce the incidence of puerperal sepsis.