

2. It is suggested that undetected syphilis may in some cases form a basis for the serious course of rheumatic infection, and, further, that the study of rheumatism may be aided by the grouping of rheumatic cases along non-rheumatic lines.

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THROAT INFECTIONS AS AN ETIOLOGICAL FACTOR IN PUERPERAL FEVER.

WITH A REPORT OF TWENTY-FOUR CASES.*

BY

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THERE are a number of possible causes of puerperal infection, and in bringing evidence in support of the theory that organisms can be conveyed from the throats of apparently healthy attendants to the patient's genital tract during labour, I do not thereby exclude other sources of infection.

Faulty antiseptic methods cannot be the sole cause of puerperal sepsis, because: (1) the rate has not fallen during the past twenty years, in spite of the almost universal use of antiseptics; (2) it occurs in cases of "born before arrival"; (3) it occurs most frequently in hospitals, in spite of the most elaborate care; (4) it occurs in the private practice of even the most careful doctors and midwives. We have therefore to look for other etiological causes which are not influenced by efficient antiseptic technique. Our quest is simplified if we confine ourselves to the study of haemolytic streptococcal infections, not only because this organism is the most important cause of puerperal fever, but also because of its special characteristics, which are invaluable in its identification.

An analysis of the cases of puerperal sepsis admitted to the recently established special block for puerperal fever in connexion with the Jessop Hospital shows that there is not, as has been supposed, a winter prevalence of puerperal infection. The same characteristics are shown by the number of admissions to the puerperal fever beds at the Monsall Hospital, Manchester¹ (Chart 1). On the other hand, there

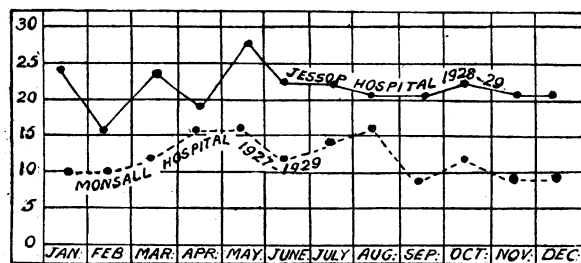


CHART 1.—Average monthly admissions of cases of puerperal sepsis, Jessop Hospital (1928-29) and Monsall Hospital (1927-29).

is a marked winter prevalence of puerperal infections caused by haemolytic streptococci, which in 1929 fell from 61 per cent. of the admissions to the Jessop Hospital in the first quarter to 14.5 per cent. in the summer quarter. This curve almost exactly corresponds with the latest available figures (1911 to 1924) of the average quarterly mortality from puerperal fever in England and Wales;² so that the type of infecting organism not only varies directly with the mortality from puerperal fever, but also with the time

* From the Department of Obstetrics and Gynaecology, University of Sheffield.

of the year when haemolytic streptococcal infections of the throat are known to be most prevalent (Chart 2).

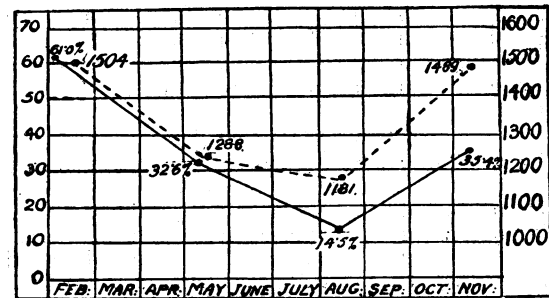


CHART 2.—Comparison between the average quarterly mortality (per million births England and Wales) from puerperal fever, 1911 to 1924, and cases of puerperal infection from haemolytic streptococci (per cent. of admissions of puerperal sepsis) to Jessop Hospital, 1929.

The following classified list (Table I) gives the causal organism which has been found in 236 cases of puerperal infection admitted to the Jessop Hospital last year. In

TABLE I.—Type of Infecting Organism in the Genital Tract of 236 Cases of Puerperal Fever admitted to the Jessop Hospital.

1929.	Total.	Haem. Strep.	Strep. viridans.	Strep.	B. coli.	Staph. albus.	Staph. aureus.	Various.
First quarter ...	59	36 (61.0%)	2	6	2	2	2	9
Second quarter ...	66	15 (22.8%)	6	5	11	18	1	10
Third quarter ...	55	8 (14.5%)	4	9	15	11	0	8
Fourth quarter ...	56	20 (35.6%)	3	5	8	8	2	10
Totals ...	236	79	15	25	36	39	5	37

addition to the winter incidence of haemolytic streptococci, an interesting feature is the relatively high proportion of infections by *B. coli* in the summer, which may be related to the dry weather at that time.

Reference to the analysis of the type of labour (Table II) which preceded the onset of puerperal fever in the cases admitted to the Jessop Hospital in 1929 shows the surprising fact that those which had spontaneous labours had the highest rate of haemolytic streptococcal infections, while "failed forceps" cases, in which there is usually the maximum amount of manipulation and trauma, were only infected by haemolytic streptococci in 12.5 per cent. of the cases admitted.

TABLE II.—Haemolytic Streptococcal Infections in Relation to Type of Delivery in 236 Cases admitted to Septic Block, Jessop Hospital (1929).

	Total.	Infected by Haemolytic Streptococci.
Spontaneous deliveries (including "B.B.A.") ...	144	Per cent. 46.5
"B.B.A." ...	[12]	41.6
Operative deliveries (including "failed forceps")	52	34.8
"Failed forceps" ...	[8]	12.5
Abortions ...	40	5.0
Total ...	236	

A most potent argument against the supposition that want of surgical cleanliness is really responsible for haemolytic streptococcal infections is found in the fact that this organism was present in only 5 per cent. of the septic

abortions, most of which were criminal. It is not to be supposed that doctors and midwives are more septic than criminal abortionists. It is probable that the latter, while infecting their victims with every other type of organism, unconsciously protect them from haemolytic streptococci by carrying out their manipulations under the clothes, which at least form an efficient mask for the "operator's" throat.

THE ENDOGENOUS THEORY.

The possibility that the patient may harbour haemolytic streptococci in her vagina requires consideration. As a matter of fact, the theory, though logically possible, rather fails from want of evidence, because it has been shown (Bigger and FitzGibbon,³ Lockhart,⁴ Burt-White and Armstrong⁵) that haemolytic streptococci are rarely present in the vagina, and only then when the woman has been recently associated with a source of infection (Burt-White⁶). Burt-White and Armstrong found haemolytic streptococci only once in fifty-five cases (1.8 per cent.), and their results have been confirmed by a much larger investigation carried out in the ante-natal department of the Jessop Hospital by Dr. Pindar and Dr. Kirk.⁷

Bigger's⁸ opinion that haemolytic streptococci are incapable of existing in the vagina as saprophytes which become pathogenic on reaching damaged tissue is supported by the figures given in Table II, which show that the cases with the greatest amount of trauma have the lowest percentage of haemolytic streptococcal infections. Thus, not only do the laboratory results agree, but they also coincide with the consensus of clinical opinion among obstetricians that, while prenatal vaginal infection is possible, it is not an etiological factor of high importance in the incidence of puerperal infection.

True autogenous infection, by which organisms pass to the genital tract from a focus of sepsis elsewhere in the body, must be a possible factor in the etiology of puerperal infection. In this series there is no conclusive example that the throat was such a focus. Among the fifteen patients who were examined, only one throat (Case 1) was found to be infected by haemolytic streptococci, and this was probably a secondary infection. In two of the cases (Cases 12 and 13) the infection travelled in the reverse direction—that is, from the patient's vagina to her throat, which, though free from haemolytic streptococci at the onset of the illness, became positive during the course of a puerperal infection caused by haemolytic streptococci. Therefore, despite the fact that I do not report an instance of genital infection from the patient's throat, we may deduce that they will be found in a larger collection of cases.

THE THROAT CARRIER THEORY.

As far as I am aware, Kanter and Pilot⁹ were the first to suggest that puerperal infection could be caused by the "spraying" of organisms on to the patient from the throat of her attendant during labour. Attention was recently focused upon this etiological factor by the publication of a report upon an outbreak of puerperal sepsis by Watson and Menely.¹⁰ The authors confess that their observations were inconclusive in regard to the mode of spread of the infection, but they based their prophylactic measures entirely upon the assumption that "throat carriers" were a prime factor in the epidemic.

CASE RECORDS.

I am aware that the cases which I am about to report do not furnish conclusive proof that the patients were infected from the throats of attendants, but the cumulative effect of the evidence is very striking, and shows, I believe, a prima facie case for further investigation. I will begin with the account of some cases which occurred in two maternity hospitals—one of which is in Sheffield—which I will call Hospital "A" and Hospital "B."

Cases in Hospital "A."

The pyrexial rate in this hospital, which is to some extent a special hospital (in that no "emergencies" are admitted), is 0.8 per cent., and the B.M.A. morbidity, which includes deaths from all causes, was 1.25 per cent. These figures show that the technique for the conduct of labour

was efficient, and they emphasize the consternation which was caused when an acute case of haemolytic streptococcal infection took place.

CASE 1.

Mrs. O., aged 28, a 2-para, was delivered naturally at full term on January 8th, 1929. She came into hospital thinking she was in labour, but, as there was no sign of its onset after six days, it was induced by castor oil and quinine. No vaginal examinations were made. The rectum was examined twice. The delivery was conducted by Sister B. and Nurse S. A small perineal tear was sutured in the lithotomy position by house-surgeon "No. 1." It is of importance to note that no haemolytic streptococci were found in a routine swab taken just before the perineal repair, so that the patient was not then infected.

On January 11th her temperature rose to 103°; pulse 140. A second culture from the vagina gave a heavy growth of haemolytic streptococci.

Result.—The patient recovered after the temperature had been elevated for fourteen days.

The antiseptic used was mercury biniodide. The skin was painted with iodine before the perineal suture. Sterile gloves and gowns were worn, but no masks.

An extensive bacteriological investigation was undertaken by the bacteriological department of the Sheffield University. The results may be summarized as follows.

TABLE III.

Name.	Source.	Haemolytic Streptococci.	Remarks.
Mrs. O.	Vagina just after delivery	Negative	—
Mrs. O.	Vagina third day	Positive	Heavy growth
Mrs. O.	Throat	"	} A few colonies
Mrs. O.	Urine } 5th day	"	
H S. No. 1	Throat and nose	"	Sutured perineum
Sister B.	Throat and nose	"	Delivered
Nurse S.	Throat and nose	"	Delivered
Nurse N.	Throat and nose	"	Nursed afterwards
Nurse K.	Throat and nose	"	Nursed afterwards
Charwoman	Throat and nose	"	No contact with patient
Remaining nurses and non-professional staff (11)	—	All negative	—
27 patients...	Throat, nose, and vagina	All negative	Five in same bed
Surgeon	—	Negative	Rectal examination before labour

The blankets and dressings were sterile.

The facts arising out of this are:

1. The patient had no haemolytic streptococci in the vagina immediately after labour, but there was a profuse growth on the third day when the temperature rose. The same organism was recovered from her throat some days later. It is impossible to determine whether this was the primary or a secondary infection; or whether her throat was infected by one or other of the "carriers" either during or after labour.

2. Six apparently healthy persons out of fifty examined were found to have haemolytic streptococci in their throats and noses; three of them were directly concerned with the delivery. Two others performed nursing duties, including toilet of the vulva, during the first three days of the puerperium.

3. The charwoman had haemolytic streptococci in her throat and nose. She was in frequent contact with the nursing staff, but had no contact with the patient or with house-surgeon No. 1.

4. None of the 27 patients was found to harbour the organism in throat, nose, or vagina.

All the staff who were found to be infected were sent off duty. One of them developed a severe haemolytic sore throat some days later.

From this time, masks made of turkey towelling, covering the mouth and nose, were worn for all deliveries. They were not used until six months later (after Cases 2 and 3) for post-partum nursing. During the ensuing six months there were no cases of pyrexia, and, though numerous ante-partum and post-partum vaginal swabs were taken, no

haemolytic streptococci were found. In July the accidental demonstration of haemolytic streptococci in the vaginae of two patients on the same day led to a bacteriological examination of the throats of the whole staff, and those of the two patients and their husbands. The details of the cases are as follows.

CASE 2.

Mrs. G., aged 27, a primipara, was delivered spontaneously at full term on July 9th, 1929. A small laceration was sutured. No vaginal examinations were made. The rectum was examined twice. The antiseptic used was mercury biniodide. Sterile gloves, gowns, and masks were worn.

On July 10th a purulent discharge from the baby's eyes led to a swab being taken from the mother's vagina, from which haemolytic streptococci were grown. This organism was not present in the throat. The puerperium was afebrile and the perineum healed well. The patient was swabbed during the first twenty-four hours by Nurse W. and Nurse B., who were subsequently proved to be "carriers." The throats of the patient, her husband, and the whole staff were negative.

CASE 3.

Mrs. C., aged 33, a 2-para, was delivered spontaneously at full term on July 9th, 1929. A superficial laceration was sutured. One vaginal and two rectal examinations were made during labour. Antiseptic measures were the same as for Case 2.

Immediately after the delivery of the placenta the nurses were called away to another case, and Nurse B. carried out the rest of the post-partum toilet *unmasked*. This nurse was subsequently proved to be a throat "carrier."

On July 10th a discharge from the infant's eyes led to a vaginal swab being taken from the mother, from which haemolytic streptococci were grown. The organism was not present in her throat or in her husband's. There was no rise of temperature during the puerperium, but the perineum did not heal by first intention. The two nurses were excluded from the wards.

The infection was apparently communicated to the patient in Case 2 from the throat of either of the two nurses who attended to her during the first twenty-four hours of the puerperium. The patient in Case 3 was probably infected from the throat of the nurse who carried out the post-partum toilet. The use of masks was therefore extended to all post-partum nursing.

No further cases of infection were discovered during the following three months. A re-examination of the whole staff was again undertaken in September because a patient developed a sore throat (non-haemolytic as it proved), but no "carriers" were found. In November, for a similar reason, the staff were again examined. On this occasion one nurse (Nurse F.) was found to have haemolytic streptococci in her throat. She was sent off duty, but inadvertently was allowed to return to the wards after one negative throat examination instead of three. This swab was probably negative as the result of recent gargling, because a few days later she was found to be again positive, and remained so for a long time.

She was a possible source of infection to a patient with whom she was in contact in the ward for two days. This patient (Mrs. B.) was found to have haemolytic streptococci in her vagina when her membranes ruptured two days after admission. No examinations had been made. Morphological differences in the organisms obtained from the patient's vagina and the nurse's throat raised a doubt as to their identity, so that this case is not included in this series.

The facts concerning these cases may be summarized as follows: During the year haemolytic streptococci were isolated from the vaginae of four patients. Two (Case 1 and Mrs. B.) had pyrexia. Case 1 was associated with six carriers. Mrs. B. was associated with still another carrier, but the identity of the two strains was open to doubt. Of the four patients, only Case 1 had haemolytic streptococci in her own throat. There have been no further infections in this hospital.

Cases in Hospital "B."

This hospital is a training school for midwives, and it employs outside midwives to give "district" experience to the pupils. The pyrexial rate for the past year has been 1.2 per cent., and the British Medical Association standard of morbidity, including deaths, was 6.45 per cent. These figures show how efficiently the work of the hospital has been done.

The history of the outbreak begins with a case of haemolytic streptococcal infection in a "district" case, whence infection appears to have spread to the hospital itself. The pupils resided in the hospital, and were, of course, in close contact with other nurses. The midwives lived in their own homes. The details of the cases may be tabulated as follows.

TABLE IV.—Cases Arising in Connection with Hospital "B." Antiseptic Methods: "District" cases, lysol; hospital cases, lysol and sterile gowns; no rubber gloves and no masks

Case and Place of Delivery.	Date of Delivery and of Onset of Fever.*	Type of Labour.	Haemolytic Streptococci.		Contacts.	Haemolytic Streptococci in Throat.
			Cervix.	Throat.		
Case 4, 1-para. Home.	Nov. 27 [Dec. 2]	Forceps	Positive	Negative	Midwife E Pupil X Doctor Husband	Positive Positive Negative Negative
Case 5,† 6-para. Home.	Dec. 3 [Dec. 7]	Spont.	Positive	Not examined	Midwife E Pupil X	Positive Positive
Case 6,‡ 3-para. Home.	Dec. 6 [Dec. 9]	Spont.	Positive	Not examined	Midwife P Pupil X	Negative Positive
Case 7, primip. Hosp.	Dec. 18 [Dec. 20]	Spont.	Septic, but no bacteriological examination		Pupil Y Pupil H	Positive Positive
Case 8, 2-para. Home.	Dec. 21 [Dec. 22]	Spont.	Positive	Negative	Midwife E Pupil X	Positive Positive
Case 9, 4-para. Hosp.	Dec. 21 [Dec. 24]	Spont.	Positive	Negative	Nurse S Pupil Y Pupil H	Left hospital, not examined Positive Positive
Case 10, 2-para. Home.	Dec. 23 [Dec. 25]	Spont.	Positive	Negative	Midwife E Pupil X	Positive Positive
Case 11, primip. Hosp.	Dec. 24 [Dec. 25]	Spont.	Positive	Negative	Nurse S Pupil Y	Not examined, left hospital Positive
Case 12, primip. Hosp.	Dec. 26 [Dec. 28]	Spont.	Positive	Negative, + 14 days later	Nurses Pupil Y Pupil V	Not examined, left hospital Positive Negative
Case 13, 2-para. Hosp.	Jan. 1/30 [Jan. 4]	Spont.	Positive	Negative, + 14 days later	Nurse M Pupil Y Pupil Z Pupil L	Not examined, had septic throat Jan. 4 Positive Positive Negative

* The first date is that of delivery, and the second [in brackets] that of onset of fever.

† Reported by courtesy of Mr. J. Chisholm.

‡ Reported by courtesy of Professor M. H. Phillips.

I have only seen the charts of Case 7, which show that patient was infected, but no bacteriological information is available.

It will be observed from the above table that in this outbreak ten patients became septic, and nine of them were proved to have haemolytic streptococcal infections, and, although there was no bacteriological examination in Case 7, her infection was probably of the same nature. Five of the patients were confined in their own homes, and four of them had spontaneous deliveries. All of these five were attended by Pupil X., who was subsequently proved to be a throat carrier. Midwife E. (throat positive) was with Pupil X. for four of the cases, and Midwife P. (throat negative) for the fifth.

Pupil X. appears to have been the innocent cause, not only of infecting these five "district" cases, but also of communicating the infection to her fellow nurses in the hospital itself; for on December 18th the patient, Case 7, who was delivered in hospital by Pupil Y. (throat positive), became septic. Then in quick succession five other women developed acute haemolytic streptococcal infections. Pupil Y. was a direct contact with five out of the six, though other positive "carriers" were concerned with some of the patients.

The matron reports that the health of the nursing staff was excellent up to December 21st, when, two days after the first septic case in hospital, a nurse developed a septic finger. Within a fortnight five other nurses were laid up with septic fingers or sore throats. Two nurses developed symptoms rather suggestive of scarlet fever, which were, perhaps, examples of streptococcal rash so often seen in

puerperal fever. The throats of the remaining twelve nurses were examined for haemolytic streptococci and six were found to be positive. It was impossible to send all the carriers off duty, so they were instructed to use antiseptic throat sprays, and those who had not had scarlet fever were given a prophylactic dose of scarlet fever antitoxin. Masks were ordered to be worn for all deliveries and for post-partum swabbing. These measures appear to have been successful, for no further cases of infection have occurred amongst either the patients or nurses up to date (five weeks).

Isolated Cases.

The evidence afforded by the following eleven instances of puerperal infection from haemolytic streptococci is all the more forcible in that the cases were unrelated with each other, and therefore the possibility of "herd" infection is eliminated. In ten cases direct contacts with the patient during labour were found to be positive throat carriers. In Case 23 the husband alone was positive, but the nurse refused to have her throat examined. The husband's throat must always be regarded as a possible source of infection to his wife's vagina.

TABLE V.—*Isolated Cases.*

Antiseptic Precautions: Records are incomplete, but where known lysol was used (vio'et-green once). Gloves were rarely worn.

Case and Place of Delivery.	Date of Delivery and of Onset of Fever.*	Type of Labour.	Haemolytic Streptococci.		Contacts	Haemolytic Streptococci in Throat.
			Cervix.	Throat.		
Case 14, primip. Home.	Jan. 16 [Jan. 17]	Spont. (7 m.)	Positive	Negative	Midwife Doctor Husband	Positive. Negative. Negative.
Case 15, primip. Home.	Feb. 11 [Feb. 14]	Spont.	Positive	Negative	Mother † Husband Doctor Nurse Father † Friend †	Positive. Positive. Negative. Negative. Negative. Negative.
Case 16, 7-para. Home.	Feb. 11 [Feb. 14]	Spont. (7 m.)	Positive	Not examined	Doctor Husband Mother †	Positive. Negative. Negative.
Case 17, 15-para. Home.	Mar. 3 [Mar. 13]	Spont.	Positive	Not examined	Handy-woman Doctor	Positive. Negative.
Case 18, primip. Home.	Mar. 11 [Mar. 13]	Spont.	Positive	Not examined	Doctor Nurse Husband Friend †	Positive. Positive. Positive. Positive.
Case 19, primip. Home.	Mar. 14 [Mar. 17]	Spont.	Positive	Negative	Doctor Mother † Husband	Positive. Positive. Positive.
Case 20, primip. Home.	July 29	Spont.	See notes ‡	Not examined	Nurse	Positive.
Case 21, 3-para. Home.	Sept. 27 [Oct. 1]	Version	Positive	Not examined	Nurse Doctor	Positive. Negative.
Case 22, primip. Home.	Nov. 19 [Nov. 20]	Forceps	Positive	Not examined	Doctor Mother † Aunt † Husband	Positive. Negative. Negative. Negative.
Case 23, primip. Hosp., mem. rupt.	Nov. 20. No fever. Died. 3 days.	3 days' labour; Caesarean section	Positive on admission, before exam. or operation	Not examined	Husband Doctor Handy-woman	Positive. Negative. Refused examination.
Case 24, 4-para. Home.	Dec. 10. Fever.	Spont.	Positive	Not examined	Midwife	Positive.

* The first date is that of delivery, and the second (in brackets) that of onset of fever.

† Present during labour.

‡ Included as controls.

§ Haemolysis of streptococci not recorded, but presumption very strong. Case 17 is reported by courtesy of Mr. J. Chisholm. The child had erysipelas.

In eight out of the eleven cases recorded in Table V labour was natural, and in two it was operative. In another, though eventually delivered by Caesarean section after three days in labour, trauma was not a factor in the infection, because haemolytic streptococci were found in the cervix on admission to hospital. No attempts had been made to deliver before she was sent in, though a number of vaginal examinations had been made.

SUMMARY OF CASES.

An analysis of the twenty-four cases here reported brings out the following points: eleven of the patients were primiparae, and thirteen had had one or more children. Labour was natural in twenty (83.5 per cent.) and operative in four (16.5 per cent.). Some form of lysol was the most commonly used antiseptic, but cases occurred in spite of the use of efficient antiseptics, and of every modern aseptic method except masks. No further cases occurred after masks were worn, in spite of the fact that in Hospital "B" known carriers had to be kept on duty.

DISCUSSION.

The correspondence between the average mortality (1911-24) from puerperal sepsis, as reported by the Registrar-General, and the incidence of haemolytic streptococcal puerperal infections admitted to the Jessop Hospital during the past year confirms the accepted opinion as to the importance of this organism in puerperal fever. It also suggests the presence of a common etiological factor.

I have shown that, while the rate of puerperal sepsis remains more or less constant throughout the year, puerperal infections by haemolytic streptococci are highest in the winter. Infections of the throat by this organism are most common during the same season, and it is almost impossible to resist the deduction that these two facts are correlated. From the ease with which haemolytic streptococci are killed, and the fact that in some cases sterile rubber gloves were worn, it is very improbable that the organisms were conveyed to the patient from the hands of the attendant. Further, it has been shown that handling is not of itself a factor in the spread of the disease, for the natural labours had the highest proportion of haemolytic streptococcal infections (46.5 per cent.), and septic abortions the lowest (5.0 per cent.).

Pre-natal infection of the vagina by haemolytic streptococci is a possible explanation of the winter incidence of puerperal sepsis from this organism, but, as I have shown, the suggestion is unsupported by positive evidence, and the facts which are known weigh against it. When the organism has been found in the vagina during pregnancy (excluding labour itself) it has not caused puerperal fever. Further, if it were a frequent inhabitant of the vagina, operative deliveries and criminal abortions should carry the highest, instead of the lowest, proportion of haemolytic streptococcal infections.

Genital infection from a remote focus of haemolytic streptococci in the patient herself must be a danger to every parturient woman. In this series of cases no such focus was found. The rectum has often come under suspicion as a cause of puerperal infection, and while I have no direct observations, on account of technical difficulties, upon the frequency of haemolytic streptococci in the faeces, strong negative evidence against their presence is found in the immunity of even extensive vaginal operations from this type of infection.

It appears, therefore, that neither the patient nor the hands of her attendants are, in fact, the general source of infection by haemolytic streptococci. On the other hand, the supposition that the patients are infected from the throats of attendant carriers affords an explanation of the facts as we know them in regard to puerperal fever. We can understand how a patient can become infected in spite of conscientious antiseptic technique during labour; and how the "B.B.A." patient, even without a vaginal examination, can be infected by the nurse who attends to the post-partum toilet. The theory explains why the risk of puerperal sepsis is highest in maternity hospitals, for one carrier in an institution will spread the infection to throats of others of the community, thereby increasing the number of infected units who are capable of "spraying" infection on to the patients in labour. The same explanation is applicable to the higher rate of puerperal sepsis in the towns than in the country.

In support of the theory, I have submitted the records of twenty-four cases in which the patients were apparently infected from the throats of the attendants. Indirect evidence is also afforded by the fact that the use of masks stopped the epidemic in Hospital "B," and prevented a recurrence in Hospital "A." Still another hospital

which adopted the use of masks seven months ago has had no case of haemolytic streptococcal infection (except one which was infected on admission) during the whole of this time, whereas previously such cases occurred with sufficient frequency to cause grave anxiety.

I conclude, therefore, that the spread of haemolytic streptococcal infection from the throats of carriers to women in labour is a factor in the etiology of puerperal fever which requires most careful investigation from every possible angle.

PROPHYLAXIS.

To those who are prepared to take prophylactic measures upon prima facie evidence, and before absolute proof is obtainable, I would make the following suggestions:

1. Masks of suitable material, completely covering the mouth and nose, should be worn by *all* persons present whenever the vulva is exposed during labour or the puerperium.
2. The occurrence of even a mild sore throat in the private home of an expectant woman should necessitate a careful bacteriological examination for haemolytic streptococci. If positive, search should be made for other domestic carriers. In any case, the patient's throat and vagina should be examined for haemolytic streptococci.
3. In institutions nurses and patients with even slight sore throats should be isolated from lying-in wards.
4. In institutions the first rise of temperature should necessitate an immediate vaginal or cervical test for haemolytic streptococci. If positive, the throats of contacts must be examined, and any carrier removed from the wards.
5. Doctors in private practice should have their throats examined at frequent intervals. If they have a case of puer-

peral sepsis, they should, for their own protection, have the throat of the patient and of all contacts examined.

6. It should be part of the duty of the Local Supervising Authority to have examinations of the throats of midwives who are concerned with cases of puerperal fever.

RECOMMENDATION.

There is enough evidence for the throat "carrier" theory to justify a full investigation. The time for isolated study has gone by, and some authoritative body should plan and control the research in selected areas. The full co-operation of the profession, and of the public health services would be essential, but, above all, the bacteriological work must be above suspicion.

The deductions made in this paper depend entirely upon the very expert bacteriological work which has been so ungrudgingly carried out in the department of bacteriology (Professor J. S. C. Douglas) by Dr. Edington in the University laboratories, and by Dr. Kirk in the laboratory attached to the Jessop Hospital for Women. The county bacteriological departments at Derby and Wakefield have also given most valuable assistance in the examination of contacts.

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SPONTANEOUS INOCULATION OF MELANOTIC SARCOMA FROM MOTHER TO FOETUS.

REPORT OF A CASE.

BY

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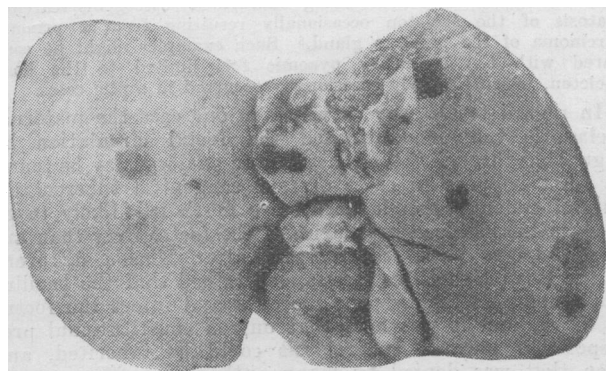
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THE following is, we believe, the first reported case of transmission of a malignant neoplasm from mother to child by spontaneous inoculation.

The child, B. M., aged 8 months, a well-developed boy of normal size, was admitted to the German Hospital on November 19th, 1929. The patient's mother (D. M., aged 27 years) had died



Inferior surface of the liver showing melanotic tumours.

at the German Hospital on July 4th, 1929, of melanotic sarcoma with visceral and subcutaneous metastases. There was no post-mortem examination, but she was known to have been suffering from melanotic sarcoma for a long time previously. Eighteen months ago she had undergone operation at the London Hospital for melanotic sarcoma of the thigh. The child was delivered on April 9th by Caesarean section at full term at the London Hospital, and was thought to be quite normal at birth. Development seemed to be satisfactory till recently, when enlargement of the abdomen and a somewhat cachectic appearance of the skin was noticed.

On admission to the German Hospital the liver was found to be enlarged, reaching down to the umbilical level, and some large, hard, rounded nodules could be felt projecting on its anterior surface, suggesting malignant neoplasm. The spleen was likewise, but evenly, enlarged, its lower border (on palpation) being three fingerbreadths below the costal margin. Otherwise the child seemed fairly healthy and quite lively and happy at first, excepting that at times there was moderate fever. Nevertheless, after some time the child began to show increasing cachexia. The Wassermann and Meinicke reactions were negative, and so was Pirquet's cuti-reaction for tuberculosis. The blood count (November 22nd) was: haemoglobin 76 per cent., erythrocytes 4,680,000 per c.mm. of blood, colour index 0.81, white cells 12,400 (polymorphonuclear neutrophils 32 per cent., lymphocytes 57 per cent., monocytes 10 per cent., eosinophils 1 per cent.); nothing abnormal was noted in the appearance of the red cells.



Lower portion of the upper surface of the right lobe of the liver, showing the melanotic tumours felt during life.

The liver and the bosses on it probably increased somewhat in size, but certainly only very slowly. About the middle of January, 1930, the child, who was gradually losing in weight and becoming more cachectic and obviously ill, developed considerable fever and left-sided purulent otorrhoea. The blood count on January 13th was: haemoglobin 60 per cent., erythrocytes 4,380,000 per c.mm., colour index 0.7, white cells 16,550 (myelocytes 4 per cent., metamyelocytes 10 per cent., polymorphonuclear neutrophils 36 per cent., lymphocytes 45 per cent., monocytes 4 per cent.). The pyrexia continued, and the child died on January 24th.

We may say here that the child's urine throughout, whenever examined, was clear and of a golden brown colour, sometimes deeper than at other times. It was free from albumin, sugar, indican, acetone, diacetic acid, and excess of urobilin or urobilinogen. The colour deepened when the urine was kept, but never became blackish. Only on one occasion (January 1st) was a supposed positive reaction for melanogen obtained—that is to say, on using the potassium nitroprussiate (Legal's) test for acetone we obtained a deep green coloration on addition of the glacial acetic acid, but this test is of doubtful value.

Necropsy (January 25th).—There were several minute subcutaneous melanotic nodules scattered over the front and back of the thorax of the emaciated child. The liver was enlarged (weighing 455 grams after being kept for some days in alcohol), and several melanotic rounded tumours (up to the size of a pigeon's egg) projected under the capsule, notably those that had been palpated during life in front of the liver. The spleen was moderately enlarged (weighing 100 grams), but was otherwise not