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THESIS FOR M. D.

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THE AETIOLOGY, PATHOLOGY AND  
TREATMENT OF PUERPERAL  
INFECTION.

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BY

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April 30. 1907.

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P R E F A C E .

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*The writer in presenting the following thesis would point out that he has not pretended to traverse fully the whole of the ground, but has rather laid stress on matters still in dispute, with a view to placing on record the latest and most certain conclusions arrived at.*

*Whilst having had considerable experience in obstetrical work, the writer has been fortunate in hitherto escaping serious infection in his own work. At the same time, he has been struck by its prevalence, and being convinced of the importance of the subject has reviewed it in the following pages.*

T. C. B.

THE AETIOLOGY, PATHOLOGY AND TREATMENT OF

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PUERPERAL INFECTION .

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Whilst puerperal infection remains so frequent an occurrence in general midwifery practice, no excuse is needed for reviewing recent work on the subject and placing on record the present position of our knowledge of the Aetiology, Pathology, and Treatment of this important affection.

No attempt will be made to give a history of the gradual elucidation of the problems of the conditions included under the term puerperal fever, and the symptomatology will only be referred to incidentally.

That the conditions are infective, and that the infective material is conveyed immediately before, during or after labour from the exterior of the body to the uterus or parts affected cannot be denied (? autoinfection *q.v.*).

Before discussing the aetiology of the disease, it is of interest to examine such statistics as are available. Dr. Robert Foxall\* gives a very exhaustive account of those

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\* TRANSACTIONS OF THE OBSTETRICAL SOCIETY OF LONDON,  
1905.

that are available previous to 1904, and comes to the following conclusions:-

(1) The total death-rate from childbirth has not diminished either in England or Wales, in Scotland, or in Ireland, where it is abnormally high as compared with other divisions of the kingdom, but in London it has declined considerably.

(2) The death-rate from accidents of childbirth has declined slightly in each division of the kingdom, but it is abnormally high in Ireland, and in London it has markedly diminished.

(3) The death-rate from puerperal septic diseases, if anything, shows a tendency to increase in each division of the kingdom, but in London has been declining for at least the last decade.

Dr. Boxall finds that, excluding the cases sent during labour, no fatal case of puerperal sepsis has occurred in the York Road Lying-in Hospital for eighteen years. The only deaths from sepsis have been in cases where the patients had been subjected to internal examinations and manipulations before admittance.

This writer gives a number of very carefully worked out tables, the facts of which he has gathered from the Registrar-General's Returns, and the returns of the York Road Lying-in Hospital, which amply prove the above conclusions.

I have analysed the returns for England and Wales during the last twenty years and find the following results:-

<u>Year:</u>	<u>Total Births:</u>	<u>Deaths from puerperal Septic Diseases:</u>	<u>Deaths from puerperal Septic Diseases per 1000 births:</u>
1886	903760	2160	2.4
1887	886331	2521	2.8
1888	879868	2457	2.8
1889	885944	1909	2.3
1890	869937	2016	2.3
1891	914157	2069	2.2
1892	897957	2439	2.7
1893	914572	3094	3.4
1894	890289	2257	2.5
1895	922291	1927	2.1
1896	915331	2123	2.3
1897	921683	1898	2.
1898	923165	1767	1.9
1899	928646	1973	2.1
1900	927062	2017	2.17
1901	929807	2079	2.2
1902	940509	2003	2.1
1903	948271	1668	1.7
1904	945389	1654	1.7
1905	929293	1734	1.8

This table shows a decided decrease in the deaths from these causes, and does not support the very gloomy view taken by Boxall, although the decrease is largely due to the decrease in the returns from the London area. It will be noticed that it is since his tables were published that there has been a very decided drop e.g. 2.1 to 1.7

per thousand births.

The diseases included under the heading of puerperal septic diseases are all deaths certified as due to Puerperal Septicaemia; Puerperal Pyaemia; Phlegmasia Alba Dolens; Puerperal Fever.

The deaths from these causes, as given in the returns for 1904 and 1905, are as follows:—

	1904	1905
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Puerperal Septicaemia	1249	1307
Puerperal Pyaemia	38	51
Phlegmasia Alba Dolens	94	103
Puerperal Fever	278	278
	-----	-----
	1654	1734
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The total number of deaths from accidents and diseases of childbed in 1904 were 3667, and in 1905 3905.

These are equal to a rate respectively of 3.88 per 1000 births in 1904, and 4.2 per 1000 births in 1905.

Taking the above puerperal Septic diseases by themselves the rates are for 1904 1.7 per 1000, and for 1905 1.8 per 1000 births. A rise of but .1 yet representing a large number of deaths, and an increase of 6 per cent in the total deaths from this cause.

Bearing in mind the feeling of dislike that any practitioner must have of attributing death to puerperal fever, one is irresistably driven to the conclusion that

the deaths from puerperal sepsis must exceed the number given by the Registrar-General considerably; and, even if they do not do so, it is still a ghastly blot on present day practice that 2000 die every year in this country from puerperal sepsis.

In addition to these fatal cases, it must be remembered that a large proportion of pelvic diseases with the accompanying chronic invalidism and distress can be traced to infection during labour or the puerperium.

#### MODES OF INFECTION.

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These are many and will be considered in detail.

The Woman and her surroundings:- Too often a medical man first sees the parturient woman when the first stage is far advanced, or in the second stage. He finds her wearing a dirty petticoat produced for the occasion; possibly it is soiled with faeces. A few papers are placed beneath the woman, and she is surrounded with the oldest and dirtiest rags and sheets that are in the house. This state of affairs more or less obtains throughout the whole of the lower classes, and does not necessarily denote extreme poverty. No attempt has been made to cleanse the vulva, or empty the rectum. She lies in this condition awaiting the expulsion of the placenta, after the birth of the child. Under such conditions as these, infection is facilitated, and any attempt to examine the passages is likely to carry in infective material, however carefully cleansed the hand of the attendant, whether medical man or

midwife, may be.

There is another possible channel of infection, which has come under the present writer's notice on more than one occasion. Namely the water used. In the country the water may come direct from a pond or stream, or a well near the house or cottage. Do those in attendance, whether doctor or midwife, realise the danger lurking here? It is of little use to wash one's hands in a mixture of boiled (sterile) and unboiled (non-sterile) water to which an antiseptic has only recently been added. Unless the antiseptic is of such a strength as to make it impossible to use, the organisms will not be killed immediately, and if carried to a suitable nidus free from antiseptic, will quickly recover from any injury they may have sustained. The writer knows of a case of puerperal septicaemia where both patient and nurse had conscientiously placed a pelket of bin-iodide of mercury in a bowl of hot water, and had always added water to cool it direct from a pond not 20 yards from the door of the house. Douches may also be sources of infection if administered on the same principle. They had been given in this way in this case. It is of great importance to bear in mind this very easy way of infecting the woman. This matter will be again referred to in dealing with the Prophylaxis.

The Midwife:— Until the Midwife's Act has been working for some years, it seems idle to hope that midwives



as a body will be trained. At the same time, the Act must gradually improve matters until the midwives will be, as they ought to be, an educated and fully trained class. It is an absolute necessity that a woman should have received a good elementary education before she can grasp all the details that she needs to do, if she is to be a safe attendant on even normal labour. Those who are enrolled under the clause allowing a woman who can produce "evidence satisfactory to the board that at the passing of the Act she had been one year in bona fide practice as a midwife and that she bears a good character" will decrease in numbers, the examinations will become more strict, and the ranks of the midwives, as a whole, will be recruited by women who are well trained and efficient. Experience of the Act shows that a large number of women who were entitled to be enrolled under the above clause have not taken advantage of it, not caring to face the responsibilities and inspection entailed by the Act.

Hitherto the midwife has too often been the means of conveying the infection, as must be the case where she is ignorant and untrained. That this is so is shown by W. Williams, the Medical Officer of Health to the Glamorgan County Council\*. He finds that the mortality in childbed is much higher in those districts where the percentage of confinements attended by midwives is high and vice-versa.

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\* THE PRACTITIONER for March, 1905.

He notes that in one epidemic he investigated, all the fatal cases occurred in the practice of one midwife. In addition, he cites instances of women acting as midwives with septic sores and abscesses about them.

The same writer has compared the statistics of death from puerperal fever in the mining districts of the North of England, where 80% of the women are attended by midwives, with other similar districts where it is the custom to call in medical assistance, and finds this point brought out very forcibly. It is useless to enlarge on the various ways in which a careless midwife may infect the patient. Even where medical assistance is called in, the custom is to have an untrained nurse who prides herself on knowing just when to call the doctor in, and possibly makes continual minor local examinations before his arrival, which she wishes to be just as the child's head is being born. It is rare for the ordinary midwife or attendant to realise what surgical cleanliness means. She may come straight from some occupation which renders her specially liable to convey infection. There is no changing of clothes, and the washing of the hands is of the most perfunctory character. Alas, too often even the "fully" trained hospital nurse falls far short in her ideas of what surgical cleanliness means. The belief that a casual rub or rinse with a disinfectant solution is all-powerful in destroying germs is only too prevalent.

As regards the medical attendant, there is little

excuse for his carrying the infection, but it must be recognised that a general practitioner, who attends all sorts of cases during the day, may run a risk of infecting the lying-in woman. It is a counsel of perfection to say that he shall not attend any lying-in woman should he have been in attendance on a septic or infectious case. The indications and precautions to be observed in these cases will be mentioned in the part dealing with Prophylactic Treatment.

It is needless to enlarge on the various ways in which infection may be carried. Mention must be made of the bag and instruments, the lubricant, etc.; <sup>also</sup> ~~to~~ the occurrence of pustules about the vulva; scratching of the parts by the hands, especially if the latter have sores or pustules upon them; and neglect to keep the parts clean.

The question of Autoinfection will be discussed later.

Predisposing causes are many. Too frequent examinations, prolonged labour, obstetric operations, long retention of the placenta with manipulative <sup>removal</sup> ~~movement~~ of the same, haemorrhage, lacerations of the perinaeum and vagina or cervix. Jellett includes mental distress, retention of lochia and too low a diet. With reference to the retention of the lochia. Kinhead, of the Queen's College, Galway, points out\* that a very possible explanation of the

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\* AMERICAN JOURNAL OF OBSTETRICS, Vol. 18.

freedom of the women in the West of Ireland from puerperal infection, though they are so poor and live in unhygienic surroundings, is the excellent drainage the vagina gets, owing to the fact that these women get up and walk about on the second or third day after delivery.

#### AUTOINFECTION.

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It is necessary to consider this important subject in some detail.

Taken in its widest sense, it will include the following distinct conditions:-

(1) Infection carried by the arterial blood from some distant part to the uterus, and there setting up trouble.

(2) The uterus itself may be infected before the onset of labour.

(3) There may be some affection of the vagina, or external parts, so that cleansing of the hands and the parts may not prevent organisms being carried into the uterus, by means of the hands or instruments, or even by actual wanderings of the bacteria themselves.

The possibility of the infection being carried to the uterus, by means of the blood has to be carefully investigated, and it is to this that the writer would be inclined to apply the term autoinfection. The latter two conditions are obviously possible.

INFECTION THROUGH THE BLOOD.

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Wormser \* records a case where the origin seemed to be in a suppurating sphenoidal sinus; the puerperal infection was a general streptococcic one, and the patient succumbed. Foulerton † reports a case where a miscarriage occurring during an attack of acute lobar pneumonia and the patient dying afterwards, the postmortem examination showed a placental fragment retained in the uterus, which was swarming with pneumococci; the latter were also present in the lochia in enormous numbers.

When we consider such a disease as acute osteomyelitis, as it often occurs in children, where it is impossible to trace the source of infection in many cases, yet the bone is swarming with staphylococci, it becomes impossible to aver that autoinfection cannot occur in puerperal women. One must admit that stray bacteria get into the blood, and reaching the head of the bone, settle there and start the trouble. For some reason, either the blood is lowered in resistance, or the bacterium is especially hardy and reaches such a favourable spot as the epiphyseal line before being destroyed. At the same time, it is only

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\*"L'infection de la cavité utérine pendant les suites de couches". LA SEMAINE MÉDICALE, Nov. 1900.

† THE PRACTITIONER, March, 1905.

a possibility to be thought of in the study of puerperal fever, and we have no right to use it as a certainty.

Montgomerie Paton\* lays stress on the possibility (certainty, he says,) of auto-infection from pyorrhoea alveolaris. He traces three cases of phlegmasia alba dolens to this cause. The effect apparently, in his opinion, of the lowering of resistance by the septic focus, but also a certain enurement to the infection, which predisposes to a mild and not virulent infection.

(2) The uterus itself may be affected before the onset of labour.

Before examining this possibility of puerperal infection, it is necessary to investigate the evidence which has been brought to bear on this point. What are the results of bacteriological examination of the non-pregnant uterus, healthy or otherwise? What organisms are found in the cervical secretion of pregnant women?

The method of obtaining this secretion is of very great importance. It is not worth while to occupy the space of this thesis with the evidence, but it is clearly proved that the following method, or a modification, is the proper one in all conditions, and all results obtained in other ways will be neglected. A sterilised tube is passed into the vagina and within it is a syringe or wire

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\* "New Serum-Therapy". D. Montgomerie Paton, 1906

bearing a sterilised swab; the end of the tube is closed with a sterile plug, which can be withdrawn at the proper time. The swab on the wire or the syringe is then pushed into the cervix. Where such precautions are not taken to prevent organisms being carried in from the exterior, errors are made.

THE HEALTHY UTERUS AND CERVIX OF PREGNANT  
WOMEN.

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The researches of Winter \* established the following facts:-

The cervical canal is blocked by the operculum - a plug of mucus - which has a bactericidal effect. The canal may be divided into three parts, a lower germ containing (not necessarily pathogenic), a middle germ destroying, and an upper germ free.

1. The healthy uterine cavity is germ free.
  2. The higher the part of the cervical canal investigated, the freer it is from organisms; until the os internum, where in the great majority of cases, there are no organisms.
  3. The cervical secretion contains organisms in every case, but except in disease they are not pathogenic. (See later).
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\* CENTRALEBL. F. GYN., 1895, p. 508.

All observers seem agreed upon these statements, including Whitridge Williams, Gonner, Doderlein and Kröenig.

Foulerton and Bonney \* examined the cervical secretion of 30 non-pregnant women who had vaginal discharge. Their results were as follows:-

Cultures of various bacteria were obtained in 16

Staphylococcus pyogenes aureus. . . 2

do do albus. . . 6

Diphtheroid Bacillus . . . . . 7

Micrococcus Gonorrhoeae. . . . . 2 ?

A Diplococcus (-Gram) . . . . . 1

Bac. Coli Communis . . . . . 1

Bacteria seen with microscope, but attempts at culture failed (cocci and bacilli). . . . 3

Attempts at culture failed and no organisms seen. . . . . 9

Attempts at culture failed and no microscopic examination. . . . . 2

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Total 30

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Can an infected uterus become pregnant? It is

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\* TRANS. OBSTET. SOC. , 1905, page 13.



unlikely if the endometrium be affected, but supposing the cervix is affected, and there is endocervicitis with the presence of any of the organisms mentioned above ?

Can an infective endocervicitis continue till labour appears- and then the body of the uterus become infected during the puerperium by these organisms producing endocervicitis ? It has to be remembered that infection has followed labour in which the hands have not been introduced into the vagina and the patient has been surrounded by proper precautions (See later . Franz quoted by Vorhees ). Granted that in these cases the infection has been mild, it has nevertheless been present. The writer knows of no investigations which bear on these points.

Bonney and Foulerton \* point out that in their cases they found certain pathological organisms in the cervical secretion, and whilst infection from this source, i.e. autoinfection, is likely to be mild, it is none the less within the bounds of possibility.

(3) The possibility of some affection of the vagina or external parts, or the presence of septic bacteria in the vagina; so that cleansing of the hands and the parts may not prevent organisms being carried into the uterus.

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"The Pathology of Puerperal Fever" by A.G.R.  
Foulerton. PRACTITIONER, March, 1905 .

THE VAGINA:

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Kroenig\* in the examination of 100 cases, finds the vaginal secretion of pregnant women, even though it was pathological, never contained septic or pyogenic organisms (except yeast and gonococci). Menge † and Williams\*\* confirm this. So that it may be stated that the vagina of every pregnant woman is aseptic, provided always that examination has not taken place previously, or not for two or three days.

Williams †† sums up the matter as follows:-

He took 25 additional cases and investigated as follows. Three sets of cultures were taken:-

1. From the hymen and inner surfaces of the labia minora.
2. From the vaginal secretion obtained through a Menge tube.
3. From the vaginal secretion obtained through a sterilised speculum.

Pyogenic cocci or Bacillus Coli Communis were found in 80% of the first or external set.

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\* CENTRALB. F. GYN., 1894.

† DEUTSCHE MED. WOCHENSCHRIFT, 1894. Nos 46 - 48.

\*\* TRANSACTIONS OF THE AMERICAN GYNAECOLOGICAL SOCIETY, 1898, page 141.

†† AMERICAN JOURNAL OF OBSTETRICS, 1898.

In the second, i. e. where the Menge tubes were used, no organisms were found.

Pyogenic or *Bacillus Coli Communis* were found in 48% of the third where the speculum was used.

This communication both confirms Williams' previous work, and explained the cause of the diversity of results obtained. He therefore maintains that the vaginal secretion is free of pathogenic bacteria, with the exception of the *Gonococcus*.

Jellett very wisely points out in his book \* that, although in the usual way these observations hold good, there are cases where there is present a septic focus, such as an abscess, or septic vaginitis, or some such condition, and in these the quantity and strength of the septic organisms must overcome and destroy the resistance of the protecting vaginal bacillus.

Wal<sup>h</sup>ard † examined 100 cases, and only found Doderlein's normal secretion in 14. He found streptococci present in 27 cases, but they were not virulent. He opined they might become so, should the <sup>vitality</sup> ~~dietary~~ of the tissues become depressed.

\* "Manuel of Midwifery", 1905, page 149.

† ARCHIV. F. GYN., Bd 48, p. 201.

The vaginal secretion may be looked upon as antagonistic to the growth of pathogenic organisms, but probably it is not so bactericidal as Kroenig states. This qualification must be made if Wal<sup>h</sup>lard's work is considered.

Vorhees maintains that the sepsis developing on a latent gonorrhoea is sometimes severe, and so is that associated with pyosalpinx, ovarian abscesses, necrosing fibroids, etc.

All parts external to the hymen are necessarily septic, especially so as they are in such close proximity to the anus; and the following bacteria are met with:— Streptococci, Staphylococci aureus and albus, Bac. Coli Communis, and many others. It is not usual to include these amongst autoinfections, as they should never be carried into the vagina by the examining hand. They should not be referred to in any way as autoinfection.

Before leaving this subject, it is important and interesting to note that Schenk and Scheib, of Prague, after investigating the lochia, come to the conclusion that more than a third of all women in normal child-bed harbour streptococci in their uteri during the puerperium, but towards its close, i. e. seventh to ninth day.\*

Vorhees † argues from several data that auto-

\* ZEITSCH. F. GEB. U. GYN., Ed LVI., Heft 2.

† AMERICAN JOURNAL OF OBSTETRICS, June, 1906.

*infection must be admitted rarely. He quotes Franz, who reports a series of 457 cases of labour without internal examination. Of these, 66 developed mild and 14 severe infection.*

THE ORGANISMS INVOLVED IN PUERPERAL INFECTION.

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Many organisms have been found in the puerperal uterus, and of these there is no doubt that the Streptococcus is the most important.

Kroenig\* examined 179 cases of puerperal endometritis and found the following organisms present:-

(a) Pyogenic . . . . .	79
Streptococcus	75
Staphylococcus	4
(b) Gonorrhoeal: Gonococcus. . . . .	50
(c) Sepsaemic . . . . .	50
including, Anaerobes	32

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Whitridge Williams † examined the lochia in 150 cases of puerperal morbidity, i.e., where the temperature rose to 101 during the first ten days and found:-

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\* KROENIG "Aetiologie und Therapie der puerperalem Endometritis." CENT. F.GYN. 1895, 422 - 432.

† "Text -book of Obstetrics," 1908.

<i>Streptococcus</i> . . . . .	81
<i>Streptococcus &amp; Bacillus Coli</i> . . . . .	5
<i>Streptococcus, Staphylococcus &amp; Bacillus Coli.</i>	2
<i>Streptococcus, Bacillus Coli &amp; Gas Bacilli</i> . . .	2
<i>Streptococcus, Staphylococcus, Gas &amp; Typhoid</i>	
<i>Bacillus</i> . . . . .	1
<i>Streptococcus, Staphylococcus, Bacillus Coli</i>	
& <i>Gas Bacilli</i> . . . . .	1
<i>Streptococcus and ?</i> . . . . .	2
<i>Staphylococcus</i> . . . . .	4
<i>Bacillus Coli</i> . . . . .	11
<i>Gonococcus</i> . . . . .	7
<i>Gonococcus &amp; Bacillus Coli</i> . . . . .	1
<i>Unidentified aerobic</i> . . . . .	4
<i>Unidentified anaerobic</i> . . . . .	8
<i>Bacillus Diphtheriae</i> . . . . .	1
<i>Bacillus Typhosus</i> . . . . .	1
<i>Bacteria seen in cover slip, but which failed</i>	
<i>to grow on any of the more usual media</i>	45
<i>Absolutely sterile</i> . . . . .	25

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*Czerniewski \* examined 91 cases and found*

*Streptococci in* . . . . . 49

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\* ARCHIV. F. GYN., 1888, XXXIII, 79.

Vogel, quoted by Foulerton \* examined 24 cases and found

Streptococci in . . . . . 7

Victor Bonney and Foulerton examined 54 cases with fever, following miscarriage or labour

40 severe cases showed Streptococci in 25

54 cases showed Streptococci in. . . . 25

The latter writers classed their cases as follows:—†

Class A. Those in which death occurred. .14

Class B. Severe cases with recovery. . . 26

Class C. Mild cases with recovery . . . 15.

In the first class, Streptococci were found in ten cases, in two pure, in six with the Bacillus Coli Communis, two with the Staphylococcus pyogenes albus and Bacillus Coli Communis.

In Class B. Streptococci were in pure culture

in 8 cases

do. with other

Bacteria in 17 "

\* PRACTITIONER, March 1905, p. 393.

† TRANS. OF OBSTERTICAL SOCIETY, 1905, pp. 22 -40.



These figures give a total of 498 morbid puerperal uteri examined with the following result:-

Streptococcus 200 or 40%.

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The *Streptococcus pyogenes*, be it a genus or species, is associated with the most virulent forms of puerperal infection, and it is most interesting to note that it was the first organism associated with the disease\*, and it was cultivated by Pasteur as early as 1880, from a case of puerperal infection. It has been found in river water, floor dust and on the skin of healthy individuals. But in as much as it is not particularly resistant, ordinary antiseptics and aseptic precautions should banish this form of infection at any rate.

It occurs in 40% as shown above.

Andrews and Horder in a series of articles in the LANCET in September, 1906,† have proposed a classification of the Streptococci based on their reactions, cultured characteristics and morphology. They distinguish the following pathogenic types:-

*Streptococcus pyogenes*

*Streptococcus salivarius*

*Streptococcus anginosus*

\* MONATSSCHRIFT F. GEBURTSKUNDE, Mayerhofer, 1865.

† LANCET, Vol 2, 1906, pages 711; 752 & 851

*Streptococcus faecalis**Pneumococcus*

It is interesting to note that all the cases of fatal puerperal septicaemia were due to the first type, which is characterised by long chains when grown in broth - the streptococcus longus of some bacteriologists.

The importance of this research lies in the possibility of getting a more accurate diagnosis of the organisms causing puerperal fever and a more accurate anti-streptococcic serum with which to combat them.

The Straphylococcus is to be found in three forms, aureus, albus and citreus. Kroenig (Op.Cit.) in the 179 cases reported by him, found the aureus in 4. Foulerton and Bonney (Op. Cit.) found the aureus in 1 of the 54 cases examined by them, and in 2 of the non-pregnant cases who had vaginal discharge. They found the albus in 3 of the 54, once alone, and twice in conjunction with the Bac. Coli. Com. Both forms are not at all rare in the vaginal secretions of the various cases reported by these writers.

Doderlein and others point out that the aureus may be associated with the Streptococcus in severe cases, but as far as records are available, it does not give rise to the severe form of infection itself.

The albus and citreus have not yet been shown to play any important part in puerperal infection.

Foulerton reports (Op.Cit.) one case, where the albus was found in pure culture from the uterus, in a case showing fever on the sixth day, and continuing to the twelfth, never rising above 100° F.

It will thus be seen that none of the staphylococci play a serious part in puerperal infection.

The staphylococci are widely spread and are found everywhere.

#### *Micrococcus Gonorrhoeae*: -

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Kroenig (Op.Cit.), in the 178 cases, found the gonococcus in 50.

Williams (Op.Cit.) , in 150 cases where the temperature reached 101°, found it in 8.

Foulerton and Bonney (Op.Cit.) in their 54 cases, did not find it, but Foulerton thinks that the unnamed diplococcus found by them may have been mistaken for a gonococcus by other observers.

Considering the prevalence of gonorrhoeal affections, it is remarkable that it does not become of importance in gonococcal puerperal infection. Is it because the tissues are to a large extent immune, having been subjected to the toxins of this organism ?

An interesting account of the influence of Gonorrhoea on the puerperium is given by Arnold Lea\*.

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\*TRANSACTIONS of the North of England Obstetrical and

Edgar \* says that when endometritis results from gonorrhoeal infection, it is mild in type and often unaccompanied by general symptoms.

*Bacillus Diphtheriae.*

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This has been cultivated by Whitridge Williams†, Nisot \*\* and Bumff.

Jellett does not think any of the reports are conclusive, but Haultain \*\*\* has reported a case and verified it by inoculation.

Foulerton and Bonney, in 2 out of their 54 cases, found 2 of a species of diphtheroid bacillus, not the same as the bacillus diphtheriae, and this they think has been mistaken by other observers, and hold that the case reported by Haultain is the only authentic one.

At the same time, the first mentioned writers found that the condition yielded to antitoxin, but they did not inoculate, so they have no conclusive proof that it was true diphtheria due to the Klebs-Loeffler Bacillus.

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Gynaecological Society, 1900. \*Practice of Obstetrics" p. 464.

†AMER. BOU. OBSTET. 1898 "Diphtheria of the Vulva". \*\*ANNALES DE GYN. ET. D'OBST. 1896, "Diphthérie Vagino-utérine puerpérale Séro-thérapie. Guéris." ††ZEITSCH. F. GEB. U. GYN., 1895.

\*\*\* TRANS. OF EDINBURGH MED. SOC., 1897.

*Bacillus Coli Communis.*

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Considering the proximity of the anus and vagina, one would expect this organism to play an important part. This, however, is by no means true. Whitridge Williams (Op. Cit.) examined 150 cases with a temperature of 101° and over, during the first ten days, and found the bacillus present in 20, in 11 of which it was present in puke culture.

Foulerton and Bonney (Op. Cit.) found it present in 17 out of their 54 cases. They hold it is the commonest of the secondary infecting organisms. The evidence goes to show that, where there is a pure infection, it does not run a severe course. Although this bacillus, when in the intestine produces gas and also forms indol, it is not yet proved that when in the uterus it forms gas. Although Gebhard\* reports <sup>of Tympani Uteri</sup> 711 cases in which he found the *Bac. Coli Communis*, either alone or with others, it is difficult to understand how it can produce gas from a proteid fluid like the lochia. Foulerton and Bonney appear to think that, where tympania uteri is found, anaerobic and other organisms are the cause.

The *Bacillus Typhosus* has been found in the lochia of an infected woman admitted into the John Hopkins

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\* VERF. D. DEUTSCHEN GESELLSCH. F. GYN., 1893.

Hospital. Whitridge Williams\* and Dobbint have also recorded a case where the bacillus was found along with other organisms, and where the blood reacted to the agglutination test.

Blumer\*\* has reported a case where the lesions were also found in the intestine.

The Pneumococcus has been found by Weichselbaum† Bar and Tissier\*\*\* and Czemetschka †††, Colin\*\*\*\*, Foulerton and Bonney†††.

Foulerton and Bonney (Ob.Cit.) , in an analysis of 54 cases including the above, found it probably in 6 cases, once in pure culture and 3 times with other bacteria, in which its identity was fully established and in two cases in which it was not confirmed by inoculation experiments.

\* AMERICAN JOURNAL OF OBSTETRICS, 1898, XXXVIII. 186-291

† CENTRALBL. F. GYNAECOLOGIE, 1898. No 34.

\*\* AMER. JOURNAL OF OBSTETRICS, 1899, XXXIX., 42 - 50.

†† WIEN. KLIN. WOCHEN., 1898, No. 28. \*\*\* "Sérothérapie dans

l'infection puerpérale. "L'OBSTETRIQUE, 1896-††† PRAGER

MED. WOCHEN., 1894, XIX, 283. \*\*\*\* MÜNCHENER MED. WOCHEN-

SCHRIFT, 1899. †††† TRANS. OBSTET. SOC., 1903.

Colin's case, reported as above, was one of abortion in which pneumococcic metritis developed, and this was followed by a pneumococcic meningitis, which was fatal.

Vincent's Bacillus has been reported as infecting a perineal tear by Schmidlechner \* . The patient died, but no organisms were found in the blood. This is what would be expected, since this bacillus does not advance into the blood vessels, or lymphatics. The local lesions were extraordinarily severe. The rapid extension, involving the whole surface of the genital canal, and the extensive destruction of tissue were very marked.

Bacillus Aerogenes Capsulatus has been reported by Stewart†, Ernst\*\*, Norris††, Wood\*\*\*, Halbin†††, Welsh, Dobbin\*\*\*\*, Little††††, Kroenig\*† and Dolerist\*.

\* ZEITS. F. GEB. U. GYN., Bd LVI., Heft 2.

† COLUMBUS MED- JOUR- August, 1898 (Stewart and Baldwin.)

\*\* VIRCHOW'S ARCH., CXXXIII. Heft 11.

†† AMER. JOUR. MED. SCIENCES., Feb. 1899.

\*\*\* MED. REC., April 15th, 1899. Ref. CENTRALBL. F. GYN, 1900, XI., p. 436, No. 16.

††† MONATSCH F. GEB. U. GYN., 1900, p. 88 - 122.

\*\*\*\* BULL. JOHN HOPKINS' HOSPITAL, Feb. 1897.

†††† ZEITS. F. GEB. U. GYN., Bd. LVI., Heft 2.

\*† VERF. D. DEUTSCHEN GES. F. GYN. , 1895, p. 498.

†\* NOV. ARCHIVES D'OBSTET. ET DE GYN., IX, p. 97 - 122, 1894.

Welch\* has reviewed the whole subject in an article.

Little found the bacillus in 10 cases of puerperal fever, including 2 cases of pure culture. In the others strepto- and staphylococci were present.

The presence of gas in the lochia may be due to several organisms; the colon bacillus, bacillus aerogenes capsulatus and various sapraemic organisms. The phenomenon known as air embolism is almost certainly due to infection by one of these air forming organisms, and the phenomenon known as tympania uteri has a like origin.

Little (op. cit.) considers the *B. Perfringens*, described by French writers, to be identical with this bacillus, and remarks on the similarity of the vibron septique of Pasteur, and the bacillus described by Ernst and Fraenkel, with this organism.

#### Anaerobic Organisms in General.

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Kroenig (Op. cit. ) found 32 out of 179 cases infected with anaerobic organisms, whereas Foulerton and Bonney (op. cit.) found them in only one of their 54 cases. It is difficult to see how they could exist in the uterus, since they are inhibited by oxygen whether it reaches them through the air, or the circulating blood; it therefore seems to follow that the anaerobic infection must be secondary

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\* BOSTON MED. AND SURG. JOURNAL, Vol. CXLIII. 1900.



to an aerobic pathogenic organism. These organisms can flourish in dead tissues, blood clot and such media.

The toxins of these organisms may produce sapraemia and death. Where they are present, the discharge is foetid, dark and may contain gas. The interior of the uterus may be in a sloughing condition, i. e. putrid endometritis.

Of the anaerobic bacilli, the tetanus bacillus has been reported by many observers. Kuchnau \* has reported a recent case where, in addition to the tetanus bacillus, there were present streptococci and bac. coli. com.

Foulerton has reported the bacillus maligni oedematis in one case †.

#### Secondary Infections.

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Reference has been made to secondary infection. It is very difficult to estimate the importance and influence of these. From what has been already said the bacillus coli and the staphylococcus pyogenes alba have been met with most frequently.

While primary infection with either of these bacteria is comparatively of minor severity, many writers

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\* BERLINER MED. WOCHENSCHRIFT, 1898

† PRACTITIONER, March 1905, p. 400.

aver that a mixed infection of streptococcus, with staphylococcus pyogenes albus and bacilli coli, increases the severity. But, bearing in mind the various differences in activity and virulence of the various toxins and the rapid amelioration seen occasionally when antistreptococcal serum is used, it is difficult to accept this view.

As Foulerton says: "It is quite possible that the secondary invasion of the uterus by the Bacillus Coli is merely an indication of the effects of an existing streptococcus infection, the virulence of which it does not materially aggravate."

THE LESIONS PRODUCED BY PUERPERAL INFECTION.

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Amongst the lesions produced by puerperal infection, those of the uterus rank first in importance, nevertheless it will be best to describe first those lesions usually produced by traumatism which may become infected and give rise to trouble.

PERINEUM AND VULVA.

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Laceration of the perineum, although usually taking place posteriorly in the median line, may occasionally involve one or both vaginal sulci. Very rarely the anterior portion is damaged, and this is usually due to operative interference, as by the shanks of the forceps pressing against the pelvic arch. The labia minora have been badly lacerated and even completely torn away. Where repair has been neglected and antisepsis not practised ulcers may result.

These are not of such frequent occurrence as formerly, owing to the greater care taken in ensuring cleanliness on the part of the practitioner and nurse.

Some writers have described diphtheritic ulcers, but in all probability they are not due to the Klebs-Loeffler bacillus. At the same time, there are authentic cases published of the true infection. (See page 26 of this thesis).

It is rare for these ulcers to give rise to more than purely local trouble. Superficial lymphangitis may occur in connection with vulvar wounds, which are septic and cause suppuration of the inguinal glands.

#### VAGINA.

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Lacerations of the vagina are by no means uncommon. They accompany in almost all cases lacerations of the perinaeum. The usual site is either to one or other side of the middle line in the posterior wall of the vagina, and they extend up one or both vaginal sulci. During forceps operations the vagina may be torn in any part, and apart from forceps the roof of the vagina may be lacerated when the cervix is deeply torn.

Kauffmann has collected nearly 100 cases in which the cervix has been more or less completely torn from its attachment\*.

In the event of infection of any of these lacerations, extension may take place and either the adjoining tissues or the veins may be affected. The latter may rapidly give rise to septicaemia or pyaemia, the former may set up pelvic inflammation and suppuration.

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\* *vid.* MONATSSCHR. F. GEB. U. GYN., 1901, p. 464.

PUERPERAL VAGINITIS.

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There has been described a diphtheritic vaginitis, and Williams describes two forms of puerperal vaginitis.

The first general, and apparently not depending on a laceration, is characterised by general inflammation of the mucous membrane, which becomes thickened, soft and red, and is quickly followed by copious purulent secretion.

The other type is characterised by the presence of a membrane, and is associated with a laceration. It may be limited to a small area exactly covering the wound, or it may spread on to the walls, and in some cases form a cast of the vagina. In only a very few of these cases can the presence of the Klebs-Loeffler bacillus be proved; they are usually septic in origin.

CERVIX UTERI.

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Although slight laceration of the cervix uteri is inevitable, it is not at all uncommon to have serious injury.

The tear may extend some way up on one or other side, and may reach the fornix. The lower uterine segment has been torn and the base of the broad ligament opened up. All these injuries, it is hardly necessary to say, are much more common in forceps cases than in others. Infection occurring may lead to pelvic inflammation and

suppuration, and eventual fixing of the uterus in a more or less abnormal position.

Peritonitis and general infection may follow the local.

## UTERUS.

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### ENDOMETRITIS .

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Endometritis is by far the commonest and most important puerperal infection. Most writers describe two forms which may attack the puerperal uterus. Depending mainly on the organisms concerned, they are described as septic and putrid respectively.

#### SEPTIC ENDOMETRITIS.

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This must be regarded as of two types, severe and mild.

As a rule, the former gives rise to a general infection; the latter generally remaining local.

The severe type of endometritis. This is due to the invasion of the tissues by organisms of a virulent character, usually the streptococcus pyogenes and occasionally staphylococcus aureus, although not uncommonly they are mixed. In these cases the lesion in the uterus is more or less limited in area, and may be quite small. Owing either to the virulence of the organisms, or to the lack of resistance of the tissues, the organisms attack

the uterine wall forming there an ulcer. They quickly spread through the tissues, and not around the cavity of the uterus. In some cases no actual ulcer can be found, and the lining of the uterus is quite smooth, yet organisms have gained an entrance, and on microscopic examination they are seen in all parts of the uterine wall, and there is a general infection.

In any case, they either reach the lymphatics or blood stream, and so again give rise to two types, the lymphatic and the venous forms of puerperal septicaemia.

On local examination, little can be detected. The lochia are often diminished or even absent. They are not foetid, but may be purulent. There is no destruction of tissue and curetting, therefore, must do harm rather than good.

The lining of the uterus is smooth, the wall more or less firm, and on microscopic examination the following changes are seen. Superficially there is a thin layer of necrosed cells and fibrin. Bumm has shown that beneath this there is in the deeper layers of the endometrium but a slight degree of leucocytic infiltration, thus showing the little resistance there is in these cases. The streptococci can be seen spreading from the surface, where they are present in enormous numbers, through the deeper layers of the endometrium into the muscular tissues of the uterus. They can be seen spreading along the lymph-

channels and the coats of the veins. When this occurs  
 septicaemia, pyaemia <sup>or</sup> ~~or~~ general peritonitis results.

The most striking result of this course of events is a fulminating septicaemia, where the organisms, apparently meeting with no resistance, pass rapidly into the general circulation and cause death, sometimes as early as the third or fourth day.

The organisms plus their toxins circulating in ever increasing numbers in the blood, quickly paralyse the nervous centres and the patient dies in a condition of shock.

The milder type of septic endometritis. However, all cases do not follow this course, and infection may be less virulent. Here the local condition may be more marked.

Instead of little or no exudate, the lochia are increased, purulent and often bloody. The uterus is large, its walls thickened by oedema. The surface of the uterus shows more marked changes than in the severer type. It approaches the putrid form. There is a severe catarrh of the endometrium, but not so much destruction of tissue as in the putrid form. Should the bacillus coli be present, the discharge is foul smelling. In other cases there is a false lining formed - the so-called diphtheritic endometritis - this is due to the character of the



exudate and is not, of course, due to the Klebs-Loeffler Bacillus. There is a greater number of cells and a less hasty liquefaction of the fibrin so that a membrane is produced. The leucocytic wall in the endometrium is more marked. This form of endometritis is often complicated by the presence of the putrefaction organisms, so that it becomes somewhat like the putrefactive form to be described.

General infection or pelvic inflammation and suppuration may take place.

There is still another type of septic endometritis that should be mentioned, and that is the mildest form. There are practically no general symptoms save a slight temperature, a tendency to constipation, the lochia are increased in quantity, are possibly a little purulent. The condition is a mild infection of the staphylococcus albus or aureus (Jellett).

#### PUTRID ENDOMETRITIS.

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Here the uterus is invaded by organisms which are only able to grow on dead material, and the presence of blood clot or dead membrane is necessary for the occurrence of this lesion. The uterus is found enlarged, soft and flabby, it contains a quantity of stinking slough in marked contradistinction to the condition in severe septic endometritis. The lochia are usually frothy, bloody and very foul. Microscopic examination shows

that the condition differs from the septic in that the leucocyte wall is well marked, is not invaded by organisms, but the actual necrosed parts are much deeper and larger than in the septic type.

It is rare if ever that either type occurs pure. There is nearly always some putrefactive element in all septic cases, except the most severe, and even in cases which appear to be putrid only, there are present some pathogenic organisms in addition to the saprophytes.

Jellett (page 914) says: - "It is probable that in many cases of putrid endometritis, irritation by saprophytic poisons is the first step towards an infection by septic organisms, which in their turn produce superficial necrosis of the uterine wall, and thereby supply further pabulum for the saprophytes".

Toxins produced by the saprophytes facilitate the advance of the parasitic i.e. septic organisms into the uterine walls; germs which are comparatively inactive become, in the presence of the decomposing material, much more virulent.

#### METRITIS.

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In all cases of endometritis, there is some general inflammatory reaction in the muscular wall of the uterus, but in some cases there appears a distinctly suppurative condition of the wall. Isolated foci of inflammation,

due to the accumulation of organisms, at a point during their passage from the interior of the uterus along the lymphatics, may give rise to small abscesses either in the muscle wall or between the muscle and the peritoneum. Again, the uterine veins plugged by thrombi may become septic, give rise to phlebitis, and to small abscesses resembling the suppurative condition caused by the sepsis taking place in the lymphatics as described above.

#### GENERAL INFECTIONS.

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Endometritis is in the most cases the initial lesion and other lesions, whether local or general, are the sequences of the infection of the uterus. The general infections will be taken first and the local ones later.

#### SEPTICAEMIA.

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As has already been said, this is a rapid and fatal sequence of a severe septic endometritis, where the organisms are of exceptional virulence and the resisting power low. There may be, as described above, little or no anatomical changes in the uterus or elsewhere, but the patient dies rapidly from poisoning of the nervous centres. In a more common case about the third or fourth day the patient has a rigor, the temperature rises to  $104^{\circ}$  or  $105^{\circ}$  and remains at about this height. The pulse increases to 100 and then 120, the lochia will be little or none, there will be no lactation, the patient becomes pinched

and sunken in countenance, and the temperature rising to  $106^{\circ}$  and the pulse to 140 - 160, the patient dies on the fourth to the seventh day of the disease, or as late as the tenth.

On post-mortem examination there is acute septic endometritis with little necrosis, and microscopically bacteria may be seen swarming through the wall, and there is little or no leucocytic resistance found. There will be sero-sanguineous effusions into the peritoneal, pleural and pericardial sacs, the fluid in each swarms with the organisms, and the membranes will show punctate haemorrhages. The viscera are large, soft, very congested and show extensive acute fatty degeneration. The blood is tarry, does not clot easily, and stains the walls of the blood vessels.

Some cases of true septicaemia develop as late as the fifth, sixth, or even tenth day, their course is not so violent, and though the condition may be serious and fatal, it is not so hopeless as the type mentioned above. However, most cases of severe infection developing later than the fourth or fifth day are of the next type to be mentioned, namely the thrombotic or venous type, which often (Septico-pyæmia or pyæmia, whereas the condition now being described is a) is more correctly described as a condition of lymphatic sepsis. The organisms are rapidly being thrown into the circulation where they probably multiply rapidly, and by their toxins poison the various systems. A term that denotes it better than any other is lymphatic sepsis or

septicaemia.

An examination of the blood shows a growth of *streptococcus pyogenes* in most cases, in fact, in all cases of virulent septicaemia. Personally the writer has found that there is no difficulty in obtaining a sample of blood for the purpose of diagnosis, and for the rational treatment of the case. The following is the recognised method, and is far more certain and speedy than trying to get accurate results from a few drops of blood squeezed from the finger tip. The arm is prepared as for venesection in every way, except that instead of a scalpel a glass syringe, holding from 10 - 15 ccs, is provided. The operator, having carried out in detail the antiseptic ritual and having the syringe, sterilised by boiling, lying in salt solution, decides on the vein he will pierce, either the median basilic or the median cephalic. The arm being tightly constricted by a bandage so that the veins are engorged; the operator fixes the vein between his finger and thumb and plunges the needle with the syringe attached into the vein against the blood stream; the result is that should the needle have been properly inserted into the lumen of the vein, the piston of the syringe is driven out slowly by the pressure of the blood and, except occasionally, there is no necessity to aspirate in the least. The most that can be of use

is a gentle easing of the piston to start the flow. The syringe is filled previously with sterile solution of Sodium Citrate, and emptied, except for a little remaining in the needle and lower part of the syringe, when the piston is pushed nearly home.

Having thus obtained the blood several tubes of broth and agar are taken and inoculated with varying amounts of the blood, or the syringe may be sealed and sent to the bacteriologist.

Within twenty-four hours or less a growth is seen, and the organism identified. The diagnosis is confirmed and then an antistreptococcic serum may be prepared by immunising an animal to the particular organisms and injecting the patient with it, or a vaccine may be used. (See later.)

This method is far more rational and scientific than the injection of a "blunderbus" polyvalent serum.

THE THROMBOTIC OR VENOUS FORM OF  
SEPTICAEMIA; SEPTICO-PYÆMIA OR PYÆMIA.

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Infection of the veins leading to thrombosis and pyaemia, often called the thrombotic form of puerperal septicaemia, is a condition in which the veins of the uterus and pelvis, or both, become thrombosed. The organisms invading the tissues, accompanied by inflammatory

changes attack the coats of the veins setting up phlebitis. Thrombosis ensues and the clot becoming infected, is softened, pieces are detached and general infection ensues.

If it originates in a septic endometritis, the clots plugging the vessels of the placental site are in like manner softened; i. e. primary thrombosis of the placental site. In other cases, the veins are thrombosed for some considerable distance, and there may be extensive thrombosis of the pelvic veins, even involving the internal iliacs. This may be detected by vaginal examination, and its importance in the treatment will be discussed later. Cases have been reported of the renal veins being affected.

In some cases small abscesses form round these veins, either in the uterus or in the pelvis. In the pelvis they may extend and give rise to pelvic peritonitis with suppuration, this may or may not extend to the general peritoneal cavity, and pyaemia may arise at any time.

There is no definite relationship between the condition of the interior of the uterus and that of the veins. The uterus may show little or no evidence of serious mischief, or, on the other hand, there may be extensive ulceration, superficial sloughing, and putrefactive changes going on. Thrombi may be found projecting from the sinuses in a necrotic condition, and the surrounding uterine tissues may be in the same state.

This thrombotic or pyaemic form of puerperal

form of puerperal infection is usually easily distinguishable from the septicaemic or lymphatic form. The onset is usually later, the temperature, whilst rising possibly to  $105^{\circ}$ , has a wider range since it is of markedly remittent type. Whilst the lymphatic form may be ushered in by a rigor, as is usually the case, the pyaemic form shows a succession of rigors at varying intervals. At the same time, it must be borne in mind that a rigor may be associated with the formation of pus locally, and that several rigors may occur before there are metastatic abscesses present. It is the recognition of this fact that may be of immense value in treatment; for it is in the early stages of this infection that operative interference may be of immense benefit, and it is Taylor's opinion\* that the ill repute of operative interference in puerperal fever is owing to the cases not being properly "picked".

If pyaemia is actually present, metastatic abscesses may be found anywhere, there may be suppuration in various joints, infective endocarditis may be set up, and blebs and bullae may form in the skin. The patient is profoundly jaundiced, the breath is often sweet in odour. General septic poisoning and exhaustion may cause death

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\* BRIT. GYN. JOUR. , May, 1906.



early, <sup>or</sup> the patient may linger for several weeks, or, rarely, recover spontaneously with an enfeebled constitution and disablement, owing to the fixation of joints or the suppuration of bone.

#### GENERAL PERITONITIS.

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General peritonitis is commonly a feature of all severe forms of puerperal infection, and often determines the fatal issue. It is present in all save the severest forms of lymphatic septicaemia. It may arise from the rupture of a pelvic abscess, or a pyosalpinx. Its origin in the thrombotic form of puerperal infection is described above. It may supervene on severe endometritis as the earliest indication of the infection becoming general. When arising in the course of a virulent septicaemia, there may be none of the classical signs of the disease, and the condition may be completely overlooked, the patient being poisoned by the toxins and the abdomen fills with pus as the patient becomes moribund.

#### PELVIC PERITONITIS.

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This varies very much in intensity, the exudation may be slight, adhesions are formed and the viscera become adherent, and there is no pus formation. There may be copious exudation, followed by pus formation and this may have been preceded and accompanied by matting of the intestines, etc., so that there is no extension to the

general peritoneal cavity. In other cases the general peritoneum becomes infected early, or it may become infected owing to the bursting of a local abscess.

#### PARAMETRITIS.

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This is a frequent occurrence, and is only of interest in the less severe forms of puerperal infection, on account of the pain and trouble it gives rise to. It frequently follows a cervical tear. Chronic pelvic trouble owing to the involvement of the pelvic viscera, such as displacement of the uterus, and the fixation of an ovary in the Pouch of Douglas is the sequel, and the symptoms of dysmenorrhoea, constant backache, constipation, and attacks of pain make up a picture of chronic invalidism.

Suppuration within the broad ligament may take place, preceded by a marked inflammatory oedema which may be detected per vaginam. The abscesses thus formed may burrow in various directions, and may open into the vagina, above Poupart's ligament into the buttock or in the neighbouring viscera, and have been reported as spreading up as far as the posterior mediastinum. Being confined in the connective tissue planes, they rarely cause peritonitis. The patient may die from septic poisoning, exhaustion, or general infection. There may be recovery with extensive matting of the pelvic organs with results as referred to above.

Although usually arising from infection of the uterus, it not infrequently follows infection of the lower part of the genital tract.

#### SALPINGO-OVARITIS.

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It is very doubtful whether a salpingitis exists without some involvement of the ovary, although some writers describe the diseases separately. It is a common result of bacterial infection of the uterus. Infection may be caused by direct extension or else, and apparently more often, by the passage, of organisms along the lymphatics. In either case the ovary is reached, and inflammation set up which may proceed to abscess formation. Most often it is bilateral. The tubes become filled with pus, and the inflamed ovarian tissue breaks down and an abscess is formed, with the result that in some cases a tubo-ovarian cyst follows which may rupture intra-peritoneally and give rise to general peritonitis. Suppuration may take place in the ovary, the tube remaining free.

In some cases there may be no suppuration, but a chronic inflammatory process. In others, the pus may form and find an outlet into the cavity of the uterus.

#### CHRONIC SALPINGITIS.

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This may follow the acute form, or the condition may become more or less chronic from the beginning, when the

infecting organism is of low virulence. An abscess may be formed, as in the above variety, forming a large tubo-ovarian cyst.

PHLEGMASIA ALBA DOLENS.

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Although there is considerable dispute as to the exact origin of the disease, there is no doubt that in many cases it is due to an extension of thrombosis in the pelvis to the lower limb. It is of importance to note that the thrombosis as it affects the veins of the lower limb enters above and proceeds downwards. Its origin, therefore, must be in the pelvis. That in many cases it is due to puerperal infection there is no doubt. Is there a preceding phlebitis in these cases? Is there a slowing of the blood stream which together with an increased coagulability causes a venous stasis?

The fact mentioned above - that the condition presents itself first in the upper part of the limb - would seem to negative any origin save a pelvic one. This being so, one is bound to favour the view that the majority of cases are due to puerperal infection. It is also possible that some cases are due to an extension of the normal thrombosis of the uterine sinuses from the uterus into the pelvic veins, and so to the veins of the limb.

Jewett (page 575 ) maintains that the infection is due to an extension of the parametritic process to the tissue surrounding the great vessels of the thigh by means of the lymphatics. In other words, a paraphlebitis is followed by a phlebitis, and a phlebitis by a thrombosis. Some maintain that the thrombosis is due to the action of the toxins on the intima of the large veins. Others again hold the view of simple extension as mentioned above.

It is interesting to note that the deaths certified as due to this affection show a progressive increase during the last five years, and also that it is an affection much more common between the ages of 35 and 45 than between 25 and 35.

For instance, in 1904, the deaths as registered from this affection were 32 in women between 25 and 35 and 49 in those between 35 and 45, whereas, of course, the number of births are very much greater in the former decade than in the latter \*.

CYSTITIS is occasionally met with as the result of a dirty catheter, and its symptoms are well known.

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\* Sixty-Seventh ANNUAL REPORT of the Registrar-General of Births, Deaths and Marriages in England and Wales, 1904.

SAPRAEMIA.

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By sapraemia we mean the circulation of the toxins formed by the organisms, and not by the organisms themselves. This takes place most typically with the putrefactive organisms, but may also take place with the other organisms mentioned above.

It is seen when large masses of clots or membrane are left to decompose in the vagina, as well as in the changes we have mentioned as occurring in the uterus. Some writers reserve the term sapraemia for the effects produced by non-pathogenic organisms, that is organisms which are only able to live and multiply in dead tissues. This interpretation seems too narrow, and it should include the group of symptoms produced by the absorption of toxins as mentioned above.

As a matter of practical experience, the diagnosis is determined by the effect of the treatment. If the symptoms subside after a vaginal douche, or the cleansing of the uterus, we are justified in looking on the case as one of sapraemia. If a putrid endometritis be present, the organisms are more likely to be anaerobic and non pathogenic.

PUERPERAL INSANITY.

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There is no doubt of the following facts:-

There may be puerperal insanity with sepsis and apparently due to it; on the other hand, there may be puerperal insanity with a clean and normal genital tract. The writer has extracted the following opinions:-

Jellett says that one of its causes is the absorption of toxins during the puerperium, but it is improbable that all cases are toxic.

<sup>well</sup>~~Jellett~~ holds that the absorption of products of intestinal putrefaction plays a very important part.

Whitridge Williams holds that infection is the most important cause.

Mercier says that often, but by no means always, there is a septic element.

Clouston believes in the frequent association of puerperal fever and insanity.

The form of insanity is essentially that of a toxic insanity.

Of course there are cases which supervene on the birth of the child and during labour, but the above remarks apply to that form which comes on during the first weeks of ~~labour~~ <sup>the puerperium</sup>. It is often accompanied by the stoppage of the lochia and septic signs, and an improvement in the

*mental condition is usually coincident with the subsidence of the septic processes.*

*It is not material to the thesis to discuss this subject further.*



### TREATMENT .

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Prophylactic treatment is of the greatest importance.

It is important for the patient, from the time that she becomes pregnant, to lead as healthy a life as possible, in order that her tissues may be ~~be~~ resistant to infection.

Previous to confinement, the lying-in room should be properly cleaned, and should have a plentiful supply of air. The bed should be simple, and the bedclothes should be freshly washed. A plentiful supply of clean linen is most desirable and necessary.

The patient should have a bath, using carbolic soap, directly the first pains commence. She should also have an enema to thoroughly cleanse the rectum, and the bladder should be emptied frequently. The patient should wear a woollen jersey stretching down to the waist, and over this a nightgown, while there should be stockings on the feet reaching to the knees. Needless to say all these must be clean. The hair should be done up out of the way. The nurse should clean the external genitals with a solution of lysol, or other disinfectant. After defecation the anus should be carefully cleansed from before backwards with the antiseptic lotion.

It is of the utmost importance that the nurse

should be dressed in clean and washing garments, and that her hands should be properly cleansed from time to time, and immersed in the antiseptic. On the part of the medical attendant, he must use all reasonable care to prevent his conveying infection from one patient to another. This especially applies to scarlet fever and septic cases. If called to a lying-in woman, he should return home, wash, and change his clothes before going to see her.

Regarding the bag, stress must be laid on the necessity of a clean bag, with washable linings and the bottles and instruments must be kept clean. All instruments should be sterilised and carried in cloths soaked with carbolic lotion, if means of sterilisation are not at hand at the home.

The importance of abdominal examination is not to be overlooked, but should always be carried out previous to the vaginal examination. By its means the position of the child, the possible presence of twins, etc., may be determined, and the vaginal examination thereby shortened.

Before making an examination per vaginam, a clean linen overall should be substituted for the ordinary coat. This should have sleeves reaching as far as the elbow. The nails and hands must be carefully tended and properly purified. The antiseptic to be used is a matter that individual men decide. The writer thinks that 1% Lysol Solution is the best in almost every way.

Some use india-rubber gloves, and the touch is little interfered with. Douching will be considered later.

The nurse should cleanse the labia with Lysol and water <sup>1</sup>/<sub>X</sub>% before the examination, and then place there a sterile pad. During the first stage of labour, one examination is usually enough, and during the second stage, do not interfere more than is absolutely necessary.

Should instruments be required, the same procedure as in surgical operations should be observed.

It is important to remember that any instrumental interference increases the liability to infection, partly because of the increased opportunities for the introduction of septic material, and partly on account of the frequency of tears, and the facility these give to the entrance of organisms.

As J. D. Malcolm says \* :- "It seems to be certain that a very small damage to tissues may enable slightly pathogenic or innocuous staphylococci to effect an entrance through apparently healthy epithelial surfaces and perhaps in other ways. The condition is an undesirable and dangerous one, because a little more damage will enable a more powerful pathogenic microbe to invade the tissues, and when a sufficient degree of mischief arises

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\* TRANS. OBSTET. SOC. 1900.

*the most virulent organisms may enter and produce their various effects as if they were introduced through an incision."*

*There is no doubt that this reasoning is sound, and applies not merely to the slight injuries and bruising which may ensue on an instrumental labour, but also to the actual tears and lacerations that may occur. These tears and lacerations must therefore be sutured in as neat a manner as possible, and this can be undertaken during the third stage in most cases. Even small tears are better attended to, as thereby a raw surface is closed.*

*Proper treatment of the third stage is of great importance in avoiding infection. Whilst complete expulsion of the placenta and membranes is most necessary on account of their liability to decompose and become the breeding ground of saprophytic and other organisms, there is great danger in any manipulative procedures of carrying the infection into the uterus. These two accepted principles being borne in mind, the accoucheur has little difficulty in applying them in practice. If possible, get the placenta and membranes away without inserting the hand even into the vagina, but should it be impossible to do this, then the attendant is justified in removing the mass with his hand properly sterilised.*

*The labour being over, the placenta removed, and*

the parts washed with antiseptic lotion, a sterile pad is placed over the vulva and fixed there.

#### DOUCHING.

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This is still a very much debated question, although, on the whole, it is falling into disrepute. In any case, the use of Higginson's syringe should be prohibited.

The arguments adduced may be put as follows:-

The advocates of douching believe that the pregnant uterus and passages may be the abode of pathogenic organisms and systematic vaginal douching tends to remove them. The others reply that bacterial examination shows that the normal woman has no pathogenic organisms present, and the douching hardens the vagina and destroys both its lubricating and antiseptic qualities. Statistics show apparently that results are better where the douching is not carried out, but the probability is that the truth lies between the two, although nearer the anti-douche opinion, and that in future douches will never be given systematically before labour, or when labour commences, but will be reserved for cases where there is gonorrhoeal infection or septic discharge.

#### PROPHYLACTIC DOUCHING.

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The matter was fully discussed at a meeting of

the London Obstetrical Society, and the weight of opinion was against it.

Dr Robert Boxall, at this meeting (May 3rd, 1905), read a paper on the "Mortality in Childbed both in Hospital and General Practice" \*. He believes strongly in the value of the prophylactic douche, and thus describes the practice he adopts in hospital work.

"Recognising the futility of attempting to determine the prevalence of gonorrhoeal and septic matter before hand, they make a routine practice of giving a vaginal douche whenever possible before delivery, and of repeating it after the placenta has come away, using for this purpose 4 quarts of 1 in 4000 sublimate solution at 110° F. before, and the same quantity of 1 in 2000 sublimate solution at 115° F. afterwards."

Dr. Griffiths and Dr. Cullingsworth doubt the value of the douche.

Jellett, Whitridge Williams, Jewett and Forthergill only advise douching where there is definite indication of old standing disease.

Dr. W.J. Gow \*\*, a Physician to Queen Charlotte's Hospital, is of opinion that any attempt to cleanse the

\* TRANS. OBSTET. SOC., 1905.

\*\* PRACTITIONER, March, 1905.

vagina is unsatisfactory.

Prophylactic douching is entirely given up in the Rotunda, both before and after labour.

Bearing in mind the almost unanimous testimony of bacteriologists as to the absence of pathogenic organisms in the vaginae of healthy women, it certainly seems advisable to only use the douche where there are any very definite indications. The actual reports of various bacteriologists are reported in the Chapter on Bacteriology.

Wormser\* , who is an advocate of prophylactic douching, gives the following table.

	Total Number of Confinements	Percentage of Afebrile Cases
1897. No disinfection of the Vagina. . . . .	933	81.9
1898. Ditto . . . . .	1,066	84
1899 Disinfection attempted	1,225	86.7

There is nothing very conclusive about these figures after all.

\*. LA SEMAINE MÉDICALE, Nov., 7, 1900.

Again, Foulerton points out that the cervical canal is the source of the most serious danger, if there is any, and that douching will not affect this.

As will have been seen above, Schenk and Scheib have found streptococci in the lochia of at least 35% of normal lying<sup>-in</sup> women from the seventh to the ninth day.

Zweifel, of Leipzig,\* urges that the clots which accumulate naturally in the posterior vaginal vault after labour should be removed some hours after delivery. He has practised it for some time, and is persuaded that it is a most valuable method.

As to douching after labour, that has now been largely given up as a routine procedure; but where there has been any interference, instrumental or manual, it is necessary to give an antiseptic douche, vaginal or uterine, depending on the special procedure which has been adopted. If the hand has been in the uterus, or if force has been applied, a careful antiseptic douching of the uterus should be carried out. The best solution, in the writer's opinion, is Lysol ½%. The catheter

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\* ZENTRALBL. F. GYN., 1906.



should be either glass or metal, and afford an easy "back-flow". The stream should be free and not projected with much force, i.e. the bore should be wide.

Dr Ferry Hart, however, makes it a rule to give an antiseptic vaginal douche after the third stage is completed.

The writer does not douche either before or after labour, or during the puerperium, unless there are definite indications for doing so, such as rise of temperature, foul lochia, etc.

One word as to direct immunisation. This is hardly likely to appeal to those who are convinced that practically all puerperal infection is preventible, but it is of interest to notice that Polano\*, of Wuerzburg, has put this method into practice, and has published his results. He appears to use a vaccine made from the dead bodies of streptococci and mixed bacteria, all pathogenic to the human body.

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\*ZEITS. F. GEB. U. GYN., Ed., LVI., Heft 3.

THE TREATMENT OF PUERPERAL INFECTION.

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There is no scope in the present thesis for a detailed account of the clinical signs, that enable one to differentiate between the various forms which puerperal infection may take, and these signs will only be referred to incidentally.

When one has reason to suppose that tears and injuries of the lower passages are the cause of a rise in temperature and the signs and symptoms pointing to this are that after a labour in which tearing has taken place, the patient begins to run a temperature which gradually rises; the vulva may be swollen and reddened, very tender and possibly oedematous. On examination one or two, or possibly more puerperal ulcers will be found either at the orifice of the vagina, or on its posterior wall. There is sometimes diffuse inflammation of the vagina. There is often pain in the passage of faeces. Occasionally, there may be superficial lymphangitis and implication of the inguinal glands. There is too a decomposition of clots, etc, in the vagina. In cases which resemble such, the vagina should be douched, the ulcers, if present, should be carefully cleansed; if stitches have been inserted and there appears to be tension, they should be divided and united at a later date.

These measures, if the douching of the vagina is continued twice daily for a few days, are in most cases quite successful.

In other cases, where the temperature does not drop immediately on or after douching the vagina, or where the symptoms are severe, no time must be lost and energetic treatment must be adopted. A bacteriological examination of the uterine discharge must be made if possible, and immediately afterwards the uterus should be examined to determine the condition of the endometrium. If there be any pieces of membrane, placenta, or necrosed tissue adhering to it, they must be gently removed with the finger (Jellett), or with a curette, and the uterus douched with an antiseptic lotion. Jellett advises that in all cases the uterus be treated as follows with an injection of 20 to 40% formalin:-

"The formalin should be injected in sufficient quantity to ensure its reaching the entire surface of the endometrium, i. e. from two to four drachms, and washed out after fifteen to thirty seconds have elapsed". \*

In any case, it is wise to plug the uterus with iodoform gauze.

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\* Jellett, page 930.

Great differences of opinion exist as to the treatment of uterine infection, as will be seen when one compares them.

Jellett advises that the curette be used only in mixed or putrid cases, and not in septic, unless there is something definite to remove. He emphasises the necessity of gentle procedure and favours the finger alone in most cases.

Foulerton \* argues that in purely putrid cases curetting does good, but it is useless in the septic form. He also lays stress on the fact that the infection is also often mixed and more harm may be done than good. He advises "in the absence of bacteriological examination or evidence, that all cases should be treated as of streptococcal origin". He points out that curetting in streptococcal and pneumonic cases cause the tissues to be infected more deeply, and advises digital examination, exploration and douches. Should the bacteriological report give a definite diagnosis, a suitable serum in large doses should be given. If this were done, he thinks, success would be more general.

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\* PRACTITIONER, page 413, March, 1905.

Bumm \* and Whitridge Williams †, are very emphatic in their condemnation of the routine use of the curette. They are of opinion that its use should be restricted to cases where there is débris, and even in these, the finger is better than the curette.

Frétsch \*\* only advises curetting occasionally.

Galabin †† states that it increases the mortality rather than diminishes it. He advises that the finger be used, and only when absolutely necessary a blunt flushing curette.

Gordon \*\*\* has found in almost every case that curetting of the uterus has been necessary. He holds that the finger or blunt curette is not sufficient in that it does not remove the important part of the tissues and he advocates the sharp curette as getting nearer the infection and removing it. He then washes the raw surface with sterile water at 120° C. and then mops the

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\* ZENT. F. GYN., 1893, p. 375.

† Obstetrics, p. 786.

\*\* ZEITSCH. F. GEB. U. GYN., 1891, XXI., p. 456.

†† PRACTITIONER, March, 1905.

\*\*\* PRACTITIONER, March, 1905, p. 348.

interior with pure Izal. In any case before the receipt of the bacteriological report he injects a polyvalent serum.

The same writer who, at the present time, probably has more personal experience of puerperal fever than any other observer, describes a series of 49 cases treated during the year 1906 at Monsall Hospital\*.

They were all severe cases sent in from the practice of doctors and midwives in the district. The gross mortality was 24 per cent. Allowing for four moribund cases, who died a short time after admission, the mortality was only 16 per cent.

Gordon shows from an analysis of these cases that streptococci were present 29 times in the uterus, and in 27 patients in whom a blood examination was made, streptococci were found in 8. In nearly all cases a laparotomy or curetting was done; in fact only eight patients were not curetted, four of whom died. Since the results obtained by this energetic treatment are so excellent, the ill effects of curetting are certainly exaggerated, and the controversy should end by the use of the puchette becoming more general.

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\* LANCET, MARCH 30, 1907, p. 876.

A great many French and American writers advocate the use of the curette.

Shall an antiseptic douche be used ?

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Many writers, especially Williams, Bumm and Kroenig, advocate the use of sterile salt solution in the place of antiseptic lotions. To the writer this appears too extreme since poisoning is hardly likely to take place with a weak solution of many antiseptics. Chinosol ¼%; Tinct iodi, Lysol and Gyllin in 1% solution in sterile water are all free from the risk of poisoning and are efficient antiseptics to any organisms they come in contact with. The writer finds Lysol a most useful antiseptic, and has not met with any ill effects when injected into septic cavities, or the uterus. In the knowledge that it is dangerous to use carbolic acid or mercurial solutions, it is better not to swing to the opposite extreme, that antiseptics are worse than useless. Should any putrefaction be taking place, surely it is only rational to use a disinfectant.

The fact that antiseptics do not penetrate very far into the endometrium is no argument against the efficient cleansing of what can be reached.

Can the nature of the infection be determined in any other way than by a bacteriological examination of the uterine discharge ?

The blood can be examined for streptococci, and should they be found, there is obviously no need for further examination.

Is a leucocyte count any use ?

It must be remembered that in pregnancy there is a normal rise and this has to be discounted. Again, in virulent infections leucopenia may be present.

Estimation of the percentage of haemoglobin and the number of reds present have been thought to be of use, but are not, because any effects produced by sepsis are too slow in their occurrence to be of any practical use.



### SERUM AND VACCINE TREATMENT.

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A considerable number of "cures" have been reported, but very few are cases which may be accepted without criticism. For the serum to be proved to be effectual in septicaemia, it is necessary to be certain that there was actual invasion of the circulation by the living organisms.

The cases reported which will bear this rigid test are few.

The difference between serum and vaccine may be put briefly as follows:- a serum is prepared by injecting an animal with emulsions of dead bacteria; increasing doses are administered until a high resistance is developed in the blood. The blood is then taken, the serum obtained from it, and it is injected into the patient suffering from the infection.

A vaccine, on the other hand, entails the cultivation of the bacillus causing the trouble, and when a growth has been obtained the mass of bacteria are rubbed up with an antiseptic, such as Lysol, to render it sterile, and minute doses are injected into the patient suffering from the infection.

The question arises, has a case of streptococcal septicaemia, as proved by bacteriological examination,

ever recovered without serum or vaccine treatment ?

The writer has been unable to trace any such instance. There are a considerable number of cases already reported where recovery has taken place after serum treatment.

Putting aside the many cases reported, in which recovery has taken place after the injection of serum, where no bacteriological examination has been made, the writer has collected the following cases and reports on this method. These are comparatively few, and it is germane to the discussion to mention cases of septicaemia non-puerperal in character.

Gordon \* reports 49 cases of severe infection, including 8 patients in whom streptococci were found in the blood. Five were given anti-streptococcic serum, of whom four recovered and one died, but even the latter death seems to have been due to a secondary cause, namely pneumonia 58 days after admission.

Of the three who were not given anti-streptococcic serum, one died within 24 hours of admission, and the other two on the third day.

It is particularly interesting, in view of the general opinion that curetting is useless and dangerous

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\* LANCET, March 30., 1907, page 876.

that of the cases who recovered, all were cured.

Rose \* reports a case of Streptococcic puerperal infection treated with a special puerperal anti-streptococcic serum with recovery.

Well marked and authenticated cases have also been reported by Sir James Barr †Thomson, Walker\*\* and a few others.

Foulerton and Bonney †† report two undoubted cases cured by a serum which they have prepared, but here the source of the streptococci has not been unequivocally stated: uterus or circulation ?

Eggel \*\*\* has reported ten cases of septicaemia treated with Aronson's anti-streptococcic Serum with a large amount of success. They all seem to have been genuine cases of severe infection, and though three died, success was marked in several.

Both Eggel and Bumm are convinced that Aronson's serum is free from danger, and is of great value in all cases of recent and ~~not~~ yet localised streptococcic

\* LANCET, Dec. 31, 1904.

† Idem, Feb. 23, 1907.

\*\* Idem, Dec., 31, 1904.

†† Idem, Dec., 31, 1904.

\*\*\* MÜNCHENERN WOCHENS., 1905, No. 32.

infection. Once pus formation has occurred, they agree it is useless.

Hamilton \* reports three serious cases in which examination proved the infection to be due to the streptococci. In all three cases, the effect of the injection of serum was most successful.

Pehan † treated 44 cases with Faltauf's anti-streptococcic serum, of which 31 recovered. The uterine secretion contained streptococci only in some cases, and they were mixed with others. The dose was a very large one (100 c.c. ) and it was administered early.

Pilcer and Ebersson give 28 cases, of which only four were fatal. There is no evidence of many of these cases, if any, being general.

The writer is quite convinced that no absolute diagnosis may be made early in the disease without a blood examination; symptoms are not sufficient in themselves to determine whether a severe local streptococcic infection exists, or whether it has reached the circulation.

The problem becomes a difficult one, and its usefulness can only be inferred by results and averages.

\* AMER. JOUR. OBSTET. 1900.

† ARCHIV. F. GYN., Bd LXXIV. p. 47.

These are conflicting, as shown by the following opinions:-

Whitridge Williams \* says:-

"Unfortunately up to the present time the results of serum therapy have not proved more satisfactory than other methods of treatment. In May, 1899, a Committee of the American Gynaecological Society, of which the writer was chairman, made an exhaustive report upon this subject, giving the complete literature and collecting all the cases treated by serum reported up to that time. They found that 352 cases of puerperal infection had been so treated with 73 deaths, a mortality of 20.74%. In a large number of cases the lochia were not examined bacteriologically, and there was therefore considerable doubt as to whether the infections were due to the streptococcus, but in 101 cases in which its presence was demonstrated there were 38 deaths, a mortality of 38.69%."

"This is very discouraging showing, especially when compared with the results obtained by Kroenig and the writer without serum therapy; the former having treated 56 and the latter 52 cases of streptococcus endometritis with a mortality of less than 4%."

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\* *Obstetrics*, page 790.

Galabin \*, whilst sceptical of the results hitherto obtained, says:-

"My own experience leads me to think it is a remedy of value, although by no means equal in its effects to anti-diphtheritic serum."

"I have known unexpected recovery to take place in very severe septicaemia after doses of as much as 50 to 60 cc. a day for several days."

Gordon† is uncertain as to its value, but thinks the polyvalent serum does good in some cases. However, his latest statistics mentioned above are most decidedly in favour of the serum treatment, since with the aid of this agent he has cures in undoubted cases of septicaemia.

Jellett says: "The value of a polyvalent serum has still to be ascertained", but "the polyvalent serum increases the chance of successfully combating the infection."

Foulerton \*\* says: "Given an exact diagnosis, an appropriate antitoxic serum, and sufficient dosage, there is no doubt whatever, in the mind of the writer,

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\* PRACTITIONER, p. 305.

† Idem p. 350.

\*\* Idem p. 415.

that the success which has attended the use of the serum in some cases of streptococic puerperal fever might become more general."

What are the conclusions one is justified in  
 -----  
drawing ?

1. There are really no serious effects reported as due to anti-streptococic serum. (?? See later, page 85) At the most there are joint pains and rashes with some reaction at the place of injection.

2. Several undoubted cases of septicaemia, as apart from local infection, have been cured by its use.

3. The dose must be a large one; at least 40 c.c. should be given during the first 24 hours, and then 20 c.c. each day afterwards.

4. If no improvement takes place in 36 hours, the serum is useless in the specific case, and a fresh serum should be procured.

5. In all cases a polyvalent serum should be used.

6. It is incumbent on the attendant, in view of these facts, to use a polyvalent serum in all cases of severe infection.

In addition, cultures should be obtained from the blood and from the uterus in these cases, and from them

a vaccine may be prepared when, if the patient be still alive and not improving under the serum treatment, small doses, i. e. up to 1 c. c. may be used. It is highly important in the use of the vaccine to estimate the opsonic value of the patient's blood with the particular organism.

In very few cases has this been done, but the case reported by Sir James Barr, and mentioned above, where the organism was cultured from the blood, polyvalent serum given till the vaccine had been prepared, and then this was administered in conjunctions with estimations of opsonic index.

Should no organism be obtained from the blood, then the streptococcus obtained from the uterus should be utilised.

The writer is inclined to discount all statistics on the value of the serum treatment for the following reasons: -

In Kroenig and Williams' cases, it is quite evident that there was no attempt made to distinguish between the various forms of infection, except that they were all streptococcic in origin. They were evidently not of a severe type as a whole.

In most cases, where serum has been given, the patient is in a grave condition and often nearly mori-



bund. The dose has not been nearly large enough to be efficient. Polyvalant serums are essential in order to make the possibility greater of meeting the right organism.

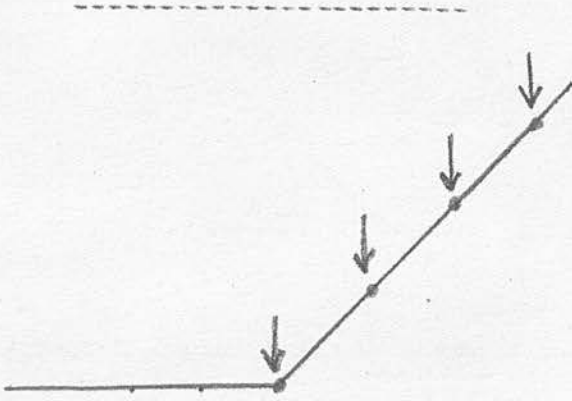
In summing up, the writer feels that the results hitherto obtained with serum and vaccine, and the many weighty and logical arguments in its favour justify one in assuming a more hopeful position in all save the very acute forms of septicaemia.

Since writing the above, the writer has had the privilege of a conversation with Sir A.E. Wright, and of reading some of his original work on the subject.

Sir A.E. Wright, as the result of his researches on the opsonic index has shown that the strength of the injection, and the period at which it is injected, have a very important influence on the results obtained.

For instance, he gives the following curves in showing graphically what the result of the injection of serum or vaccine may be.

FIGURE 1.



In Figure 1., a representation is shown of what the administrator, in the administration of anti-serum aims at. At each injection, as indicated by the arrows, there is a rise in the bacteriological action of the blood, as estimated by the opsonic index.

FIGURE 2.

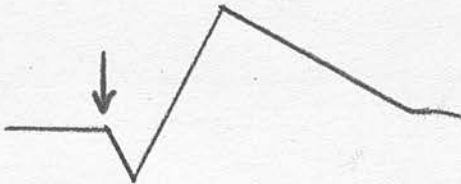


Figure 2. shows what happens with an ordinary inoculation of a vaccine.

FIGURE 3 .



Figure 3., shows a curve where a small dose of the vaccine is administered.

FIGURE 4.

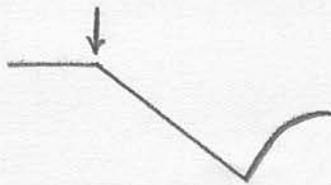


Figure 4. shows an effect of a large dose where the positive phase is abolished.

FIGURE 5.



Figure 5. shows the effect of a series of inoculations where each inoculation operates as an independent event.

FIGURE 6.

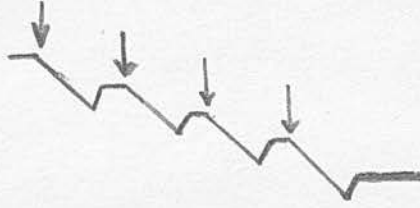


Figure 6. shows the effect of a series of inoculations where a cumulative effect is produced in the direction of the negative phase. A result that Sir A.E. Wright suspects is very frequently achieved when the inoculations are pushed.

FIGURE 7.



Figure 7. The inoculations may produce a cumulative effect in the direction of the positive phase. According to Sir A.E. Wright, an effect rarely realised in man.

FIGURE 8.

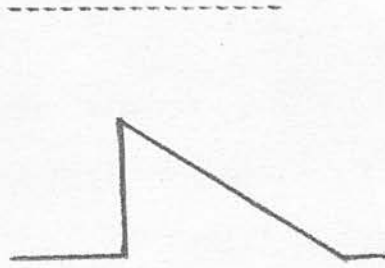


Figure E. shows the effect which one expects on the injection of a serum.

FIGURE 9.

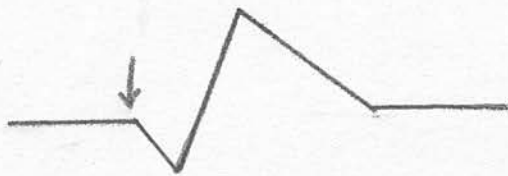


Figure 9. shows the effect of the inoculation of a vaccine.



In an address to the Chelsea Medical Society, and afterwards published \*, Sir A.E. Wright sums up the position as follows:-

1. The anti-sera may contain a certain quantum, not necessarily a therapeutically useful quantum, of protective substances elaborated by the horse, or they may be inert, or finally they may contain bacterial elements derived from the culture originally inoculated into the horse. Anyone of these three varieties of serum may at present be sold to you under the denomination of anti-serum.

2. The scheme of dosage which would be indicated in the case of a serum which contained only protective substances would, if followed in the case of a serum, such as was last in question, i.e., containing bacterial elements, be erroneous.

3. In like manner, a scheme of dosage, such as would be appropriate in the case where the serum is the equivalent of a bacterial vaccine, would, in connection with a true anti-serum, be absolutely ineffective.

4. Lastly, the only brilliant results which have been achieved by serum therapy on a series of cases,

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\* CLINICAL JOURNAL, May 16th, 1906.

have been achieved by the inoculation of a serum which may be presumed to have functioned as a bacterial vaccine.

( The latter paragraph refers to the brilliant results obtained by Prof. Chantemesse, in the treatment of typhoid fever by his anti-typhoid serum. )

The above conclusions point clearly to the cause of the varying results obtained by the serum treatment, and point most emphatically to the necessity of the sera being proved to be non-toxic before administration, and to the possibility of vaccine treatment becoming, were it more carefully employed and with accurate opsonic estimations, a most valuable therapeutic agent. The aphorism which must be distinctly borne in mind is that, if it is a serum, almost any quantities can be given, but if a vaccine minute doses are indicated.

The obvious course appears to be that no sera should be sent out as anti-sera until absence of their toxic effects has been proved by experiments on susceptible animals. Where the opsonic index of the horse is taken at the same time as the injections, and its rise is a definite and distinct one, there is not likely to be any toxic element in it.

It is only right to mention that of the two remedies the serum would be more efficient, as it can be produced at once, whereas the specific vaccine cannot

be obtained for a day or two.

Again, as has been pointed out previously, if the serum is a true anti-serum to the specific organism causing the infection, the effect is very rapid, and its good results are seen in a few hours.

In the writer's opinion, provided safe anti-serum can be obtained, all cases of streptococcic infection, whether local or general, should be treated by the serum and, if effectual in lowering the temperature and improving the condition, repeated doses should be given.



OPERATIVE TREATMENT .

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This has in its various forms received the approval of several eminent men, including Taylor, of Birmingham, and Pryor, of New York.

It has, however, received little support as a routine procedure and operation is, as a rule, only undertaken when definite indications, such as pus formation, are present.

Taylor reports several cases of operative treatment of the thrombotic form of puerperal infection. He opens the posterior vaginal fornix; or whatever part of the vaginal roof seems "chiefly affected to search for small abscesses or pockets of pus in the uterine wall and in the broad ligament; to empty these, stuffing the little cavities with moist iodoform gauze; and finally, unless it has already been done in the course of the operation, to open the pouch of Douglas, examine the parts from within the peritoneum, specially feeling for any abscess of the ovary, freely opening if present, or removing the ovary affected, and if there is no further work to be done, leaving a thick piece of iodoform gauze behind the broad ligament, and more or less surrounding the inflamed vessel".\*

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\* BRITISH GYNAECOLOGICAL JOURNAL, May, 1905, page 78.

The cases where this procedure is undertaken, and he gives three examples, are those where the infection comes on somewhat later than the acute lymphatic septicaemia, and is characterised by thrombosis of the uterine and ovarian veins, and clinically by the symptoms of pyaemia. In these cases, he believes, and the cases he gives support his statements, that the infection is still local and pre-pyaemic !

Taylor says:-

"In all these cases", i.e. of the thrombotic form of puerperal fever, "whether fatal or not, there is a more or less definite time during which, in spite of two or even more rigors, the disease is still essentially local."\*

The logical and ideal operation in these thrombotic cases would seem to be that of ligature of the large veins, as in middle ear disease, but it is rarely possible, since it would involve an extensive abdominal operation. Perhaps with spinal anaesthesia, where the shock of an operation seems to be much lessened, it may again be tried, but statistics at present are not encouraging.

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\* BRIT. GYN. JOUR. , May, 1905.

For instance, in ten cases reported and collected by Opitz \* there was only one recovery.

Cuff † narrates a case of puerperal pyaemia treated by operation, in which a mass of thrombosed veins were found in the broad ligament. These were all ligatured, including the ovarian, and recovery ensued. He collects five other somewhat similar cases treated successfully in this way.

Grendelenburg \*\* reports a successful case.

Bumm †† reports two instances of chronic pyaemia, where he had obtained an uninterrupted recovery by ligaturing the hypogastric veins as suggested by Freund.

Bumm \*\*\* reports five cases of chronic and acute pyaemia which he treated similarly and had three recoveries, one case being acute.

He strongly advises tying of the hypogastrics and excision of the ovarian veins, in preference to extirpation of the uterus.

\* DEUTSCHE MED. WOCHENSCH., 1904.

† JOUR. OBS. BRIT. EMPIRE., May, 1906.

\*\* REPORT of Internat. Congress of Obst. & Gyn. 1902.

†† MUENCHENER WCHNS., 1904, page 2115.

\*\*\* BERLINER KL. WCHNS., 1905.

In the treatment of pelvic suppuration, or of general peritonitis, ordinary methods are employed, and there is not space for their detailed description. If there is pelvic suppuration alone, the vaginal route is indicated, and if general, then free drainage of the abdominal cavity, without flushing is the only treatment that is likely to give any good result.

Leopold \* gives a detailed report of the following cases:-

	Recovered.	Died.
Five cases of acute generalised peritonitis . . . . .	3	2
One pyaemia and purulent phlebitis . . . . .		1
Five cases of localised peritonitis . . . . .	5	

Taking the general infections, this gives a mortality of 50 per cent.

The three cases which died were all very far advanced.

Kownatzki † showed at the Berlin Medical

\* ARCHIV. F. GYN., Bd IX.

† BERLINER K. WCHNS., 1905.

Society, in 1905, three patients cured out of five by laparotomy and drainage. He advocates exploratory puncture with a Pravaz needle to determine the diagnosis at the earliest possible moment, and lays stress on the importance of counter drainage.

Sourdelle \* observed five cases which were treated in this way and four recovered.

Pryor † reports 37 cases of commencing puerperal sepsis, which he treated by evacuating the uterus, opening the pouch of Douglas from the vagina, packing both uterus and the pouch of Douglas with iodoform gauze.

Ten of these cases had been curetted previously, and in these the mortality was very severe. In the 27 which had not been curetted previously, there was only one death. The peritoneal fluid contained streptococci in almost all the cases.

In Gordon's 49 cases (Op. Cit.) operative treatment was resorted to in 21, of whom 9 died.

The operative measures were as follows:-

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\* C. R. SOC. OBSTET. GYN. PEAD., 1905.

† NEW YORK MED. JOUR., Aug, 28, 1908.

	Number	Deaths
Vaginal hysterectomies . . . . .	2 . . . . .	2
Abdominal hysterectomy . . . . .	1 . . . . .	1
Pelvic abscesses opened		
per vaginam . . . . .	4 . . . . .	1
Laparotomy . . . . .	14 . . . . .	5
<hr/>		
General Peritonitis 7 Died 2		
Pyosalpinx . . . . .	2	
Pelvic Suppuration 3 " 2	3 "	2
Not specified 2 " 1	2 "	1
	<hr/>	
	14	5
	<hr/>	

Five of those operated on by laparotomy were proved by blood examination to be suffering from septicaemia, and of these 3 died.

The results, therefore, of operative interference, apart from hysterectomy, are comparatively very good.

It is worthy of note that all the cases who recovered were cured.

HYSTERECTOMY FOR PUERPERAL INFECTION .

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This has very few advocates in this country, and I have been unable to find one writer who supports it.

Galabin \* says hysterectomy has proved to be a dangerous operation.

Jewett † collects 112 cases of hysterectomy for uterine sepsis and finds the mortality 48 per cent.

Mouchotte, in his Thèse de Paris, reports 12 cases with six deaths.

Spencer records a case where he removed the uterus in putrid endometritis, which would not respond to other measures, with complete success.

Lush advocates it in the thrombotic form of puerperal fever before there is acute pyaemia.

Schmidlechner \*\* reports a case of Metritis Desiccans, where there was practically a gangrene of the puerperal uterus. The greater part of the cervical wall and of the lower third of the uterus was changed

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\* PRACTITIONER, March, 1905.

† AMERICAN GYNAECOLOGY, February, 1903.

\*\* ARCHIV. F. GYN., Bd. LXXVIII.

into a crumbling mass. Extirpation was followed by complete success.

Vorhees \* reports a case of staphylococcic infection complicated by myomatous disease of the uterus, where he extirpated the uterus with success. He advocates the operation in certain cases of sapraemia, but rarely, and appears to consider that some cases of pyaemia may be advantageously treated in this way.

Gordon (Op. Cit.) reports three cases with no recoveries.

One may say, therefore, that there are certain cases where extirpation of the uterus may be of value, but at the same time, it is very difficult to decide when this should be done.

Two recently introduced therapeutic agents may be noted:-

*Injections of colloidal silver.*

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*Intravenous injections of collargol have been carried out at the Lying-in Hospital at Bucharest for severe puerperal infection with apparently good results.*

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\* MONATS. F. GEB. U. GYN., Bd XXIII.



The actual condition of the patients is not fully described, but 28 cases recovered out of 28 treated.

### **Nuclein..**

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Nuclein has been given by the mouth and hypodermically in order to provoke artificial leucocytosis.

The writer knows of one case where it was used, but without effect either in raising the number of leucocytes, or in saving the patient.

What then should be our plan of campaign when  
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 confronted with signs of puerperal infection ?  
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Unless the symptoms are very mild, the uterus should be examined immediately in a methodical manner. A sterilised swab should be carefully inserted into the uterus by the aid of speculum, volsellum and vision. This should be sent for bacteriological diagnosis.

Should there be any debris, or indications of material that needs removing, the curette should be used. The uterus should then be douched with a disinfectant, such as Lysol, or Perchloride of mercury. It should then be swabbed dry, and pure Izal (Gordon) or Peroxide of hydrogen, e.g. Merck's Perhydrol - 100% H.O. applied carefully to the whole of the interior of the uterus.

*It should then be packed with sterilised iodoform or izal gauze.*

*In addition, should pelvic suppuration, or peritonitis, local or general, be even suspected, the appropriate operative measures should at once be carried out.*

*Hysterectomy would appear to be very rarely called for, and practically never in the early stages.*

*Anti-streptococcic serum should be injected to the amount of 50 or 100 c.c. never less. If the effect is good, then the dose may be repeated. The practitioner should, as far as he is able, ascertain that it is a reliable serum. (vide Sir. A. E. Wright ).*

*The diagnosis having been made, and the above treatment carried out, there is no objection to giving morphine for pain or sleeplessness, since rest is a most important factor in aiding recovery.*

*Alcohol should also be freely given.*

*To sum up:-*

*Puerperal infection is preventable. If it occurs there is no one line of treatment. Each case must be considered on its merits, early realisation of the*

*presence of infection, promptitude in combatting it,  
caution, not delay, in adopting heroic measures, and  
readiness to substitute one method for the next when  
the first fails, are the essentials of success.*

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