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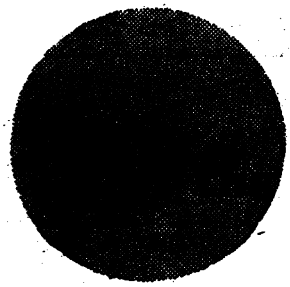

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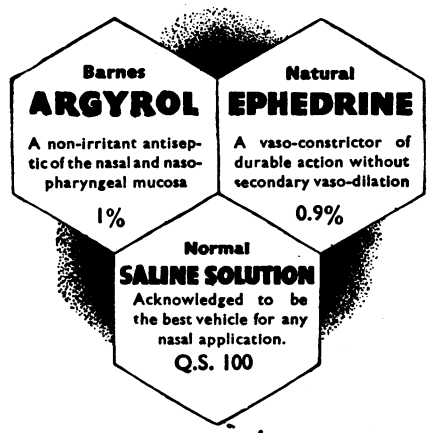

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VOL. XII

PUBLISHED BY
THE ULSTER MEDICAL JOURNAL
1943

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THE ULSTER MEDICAL SOCIETY

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Dear Sir (or Madam),

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The subscription to the Society is one guinea for Fellows and Members living in the country; two guineas for Fellows living in Belfast; and one guinea for Members living in Belfast who are not qualified more than seven years. The payment of a sum of twenty guineas entitles one to election to Life Membership.

May we, therefore, appeal to you to join the Ulster Medical Society, and so enable us to widen its influence and sphere of usefulness still further? Please make application to the Honorary Secretary, which will ensure your name being put forward for election to membership of the Society.

If you do not wish to become a member of the Society, will you consider entering your name as a subscriber to THE ULSTER MEDICAL JOURNAL? The subscription is five shillings per annum, payable in advance to the Honorary Treasurer.

We remain,

Yours faithfully,

WILLIAM DICKEY, *President.*

KENNEDY HUNTER, *Hon. Secretary.*

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THE ULSTER MEDICAL JOURNAL

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6. Editorial communications should be sent direct to the Acting Editor, Dr. Marshall, 9 College Gardens, Belfast.

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DATES OF PUBLICATION

For the duration of the present war it is hoped to issue two numbers each year: on 1st April and on 1st October.

The Royal Medical Benevolent Fund Society of Ireland

(Co. Down Branch).

To the Editor of The Ulster Medical Journal.

Sir,—It ought not to be necessary to draw the attention of the doctors in this or any other county to the merits of this Society. In many cases, unfortunately, it has been not only necessary but fruitless as well, judging from the results of a recent appeal.

In this county there are about one hundred and twenty doctors, of whom seventeen have been subscribing an average of less than a pound per head per annum. Three of these subscribers have failed this year so far.

At the beginning of the year a written appeal was addressed to each non-subscriber. A banker's order and a stamped addressed envelope was enclosed with each appeal. Assuming that heretofore want of subscriptions was largely due to want of knowledge and want of thought, a good response to this appeal was expected; alas for much of our expectations. The number of subscribers rose to twenty-five, just over 20 per cent., averaging slightly more than a pound per head. Was it too much to hope that each doctor would send us the fee he would receive for one or even two visits made by him during the year?

At one of the meetings this year an application was received on behalf of two young girls whose father, like so many doctors, had died before he could provide for their education. One of these girls wants to become a radiographer, and the other has still to complete her secondary education. We could not help a great deal because we have not sufficient funds. That is only one of many cases.

I shall be grateful indeed if those County Down doctors who have delayed to reply to my letter will do so: they cannot give to a more deserving cause.

I am, Sir,

Yours faithfully,

Paddy J. Moore,
Hon. Secretary.

Corbally House,
Bishopscourt,
Downpatrick.

[May we add a word or two to support Dr. Moore's appeal to his colleagues for more than "one more shot for the honour of Down"? The Belfast and County Antrim collection has been disappointing this year, too, and is £90 less than last year's record.—Ed., U.M.J.]

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:: PUBLISHED ON BEHALF OF THE ULSTER MEDICAL SOCIETY ::

Vol. XIII 1st MAY, 1944 No. 1

THE HEALTH OF THE STUDENT

In recent years increasing interest has been taken in the physical fitness of young men and women entering universities. In a letter to "The Times" of 21st March, 1942, Sir Charles Wilson (now Lord Moran) advocated the institution of the medical examination of students and nurses. In the University of Sheffield an optional examination was commenced in 1941, but this was made compulsory in 1942, and similar measures are contemplated, or have been already undertaken, in the United States, in Canada, in London and in Dublin.

In December, 1941, the suggestion was made to the Medical Faculty of the Queen's University of Belfast that medical students should be examined on enrolment and again before commencing clinical studies in the third year, and that radiological examination of the chest should be carried out in every case. The reasons given were, that cases of incipient tuberculosis or other infectious diseases could be detected at an earlier and possibly curable stage; that a recent survey in England had shown that six per cent. of medical students gave evidence of tuberculosis; that students are closely congregated in lecture room and laboratories, and that resident pupilship in hospitals is now compulsory, where the risk of infection of bedrooms is therefore of great importance. It was not suggested that only those students who were free from all evidence of disease should be accepted, but rather that others, those in whom some disability was found, should be guided in their choice of a career.

These representations were very fully considered in turn by the Medical Faculty, the Academic Council, and the Senate. It was felt that medical examination should not be limited to medical students, but should be applied to those of other faculties.

The following regulations were approved by the Senate on 21st July, 1943:—

1. Students entered the University are required before or during the first term of the session to undergo examination by medical practitioners appointed by the University. A woman student may, on request, be examined by a woman practitioner.

2. This examination will generally begin in September of each year and will be held in the University.

3. Enrolment in the University will not depend on the result of this examination, but advice on health matters may be given, which may in some cases involve a recommendation to postpone or modify the proposed course of study. Information will be regarded as strictly confidential.

4. Examination will be repeated at the discretion of the examiners, and re-examination is compulsory for all medical students before entering upon their clinical studies.

5. The following classes of students, always provided that they are not resident in a University hostel, will not be medically examined except at their own request :—

Students reading for higher degrees or for a post-graduate diploma or for the certificate in Social Studies, students in the faculty of Theology, and non-matriculated students in any Faculty, except students in the School of Dentistry.

REVIEW

STRUCTURE AND FUNCTION AS SEEN IN THE FOOT. By Frederick Wood Jones, D.Sc., F.R.S., F.R.C.S., Professor of Anatomy, University of Manchester. Pp. iv and 330. 150 Illustrations. London : Bailliere, Tindall & Cox. 1944. 25s.

"MAN's foot is all his own. It is unlike any other foot. It is the most distinctly human part of the whole of his anatomical make-up." Few would be inclined to agree, at first glance, with Professor Wood Jones' assertion. Yet a little anatomical and morphological reflection will begin to shake one's vague idea that the foot is a crude affair compared, say, with the hand ("a ridiculously simple and primitive appendage").

This book will help one tremendously in such reflection. It progresses beautifully from chapter to chapter, lucidly setting forth each structural element and its functional implication, yet in no sense divorcing one part from another. One is left after the last page with an idea first and above all of the whole foot, and only after that does one recollect its interdependent components.

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3. Enrolment in the University will not depend on the result of this examination, but advice on health matters may be given, which may in some cases involve a recommendation to postpone or modify the proposed course of study. Information will be regarded as strictly confidential.

4. Examination will be repeated at the discretion of the examiners, and re-examination is compulsory for all medical students before entering upon their clinical studies.

5. The following classes of students, always provided that they are not resident in a University hostel, will not be medically examined except at their own request :—

Students reading for higher degrees or for a post-graduate diploma or for the certificate in Social Studies, students in the faculty of Theology, and non-matriculated students in any Faculty, except students in the School of Dentistry.

REVIEW

STRUCTURE AND FUNCTION AS SEEN IN THE FOOT. By Frederick Wood Jones, D.Sc., F.R.S., F.R.C.S., Professor of Anatomy, University of Manchester. Pp. iv and 330. 150 Illustrations. London : Bailliere, Tindall & Cox. 1944. 25s.

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The Surgery of Pulmonary Tuberculosis

A ROBERT CAMPBELL ORATION

By G. R. B. PURCE, M.C., M.CH., F.R.C.S.EDIN.

MR. PRESIDENT, SIR THOMAS HOUSTON, LADIES AND GENTLEMEN,

"Some there be, which have no memorial:
Who are perished, as if they had never been;
And are become as if they had never been born."

In this category of Ecclesiasticus, Robert Campbell was not to be placed, for such was the esteem in which he was held by his colleagues, that his memory has been perpetuated in a way which falls to the lot of a very few; in a Memorial Oration, which now it is my proud duty and privilege to deliver.

I deem this occasion to be the greatest honour of my life, but I felt very humble when I was asked to deliver the Oration by Sir Thomas Houston, the secretary of the Committee, who is now, alas! the only survivor of the original trustees. Long may he continue. One of Robert Campbell's greatest friends, and mine also, Dr. James Moore, was the last of the trustees to cross the bourne.

Someone has said that no one knew a man better than his house-surgeon, so I should know what Robert Campbell was like, for I was both a pupil in his wards, and later his house-surgeon.

I can see him as clearly now as then: a tall, austere figure, stalking slowly and deliberately down the hospital corridor: but his forbidding exterior covered a very kindly heart, as I quickly learned, even as a timid pupil.

He was a man of very few words when I knew him, but I learned more from his silence and his precepts of action than I could have learnt from one much more voluble, for it was intriguing to find out, from many sources, why he did certain things, and arrived at certain diagnoses. When he did talk, his teaching was remarkable for its concise and logical presentation; but he was at his best sitting over a cup of tea in the ward kitchen, discussing surgical and other matters with a fascinating clarity and breadth of vision.

An amusing couplet was made about him in the hospital alphabet—

"R stands for Robert, whom you know, boys and girls,
Does not believe in the casting of pearls."

Robert Campbell had a great brain and was a most original thinker: he was no follower of fashion. He was the first clearly to distinguish the acute mechanical obstruction of the appendix from the acute inflammation, and on this very platform, in the year 1912, read a paper to this Society on that subject. He will be remembered, too, for his pioneer work on hernia, and showed that it was possible to do a radical cure in the youngest infant. His series of cases reached 1,500, with only one death, and that one from delayed chloroform poisoning, which cause of death he was one of the first to attach importance to.

He was not a spectacular operator. His work was characterised rather by meticulous care and precision. Speed, for its own sake, was not one of his gods, although he was not slow. Anyone to-day would be proud of the results he achieved.

He was a man of great character; incapable of intrigue; direct and sincere in his words and actions.

My memory of him is kept constantly green, for I pass very frequently the house where he spent his youth, and the place where he now lies.

He died in 1920 at the early age of 55.

"There be of them, that have left a name behind them,
That their praises might be reported."

It seems proper, since Robert Campbell was a surgeon, that this address should deal with a surgical subject. I have chosen one aspect of the surgery of the thorax, in which, as you are well aware, very great advances have been made in recent years.

My interest goes back to the last war and its chest wounds. It was stimulated further in 1925 when, at Sir Thomas Houston's suggestion, I went to Germany in order to learn about the surgical treatment of pulmonary tuberculosis. At that time Ludolf Brauer of Hamburg was a continental authority on this form of treatment, and indeed he was its chief pioneer, having collaborated with Friedrich of Königsberg (the Friedrich who is now remembered for his advocacy of "excision" of war wounds) in carrying out a very extensive form of thoracoplasty in 1907.

At the present time almost 70 per cent. of the thoracic surgery done is undertaken for the relief of pulmonary tuberculosis, a manifestation of the disease which is responsible for one-sixth or therabouts of the total number of deaths in the world, and which exacts such a toll in the young between the ages of twenty-five and thirty, and again in middle life between forty-five and fifty-five. In Ireland it still stands third among the killing diseases.[1] In Belfast in 1942 there were 369 deaths due to it. This war has already produced a real increase in all age groups.[2]

I feel, therefore, that I may be excused if I devote myself to the subject of the surgery of pulmonary tuberculosis, and this may be interpreted as indicating almost entirely surgical pulmonary collapse.

It may be that the future holds in store some potent chemotherapeutic agent, and one may be forgiven for wishful thinking as to this, in these days when the sulphonamides have proved so useful and reports of the efficacy of penicillin are so heartening, but the tubercle bacillus is a very doughty opponent and will, I am sure, not readily succumb. It has caused many disappointments.

Gold, of course, has been used enthusiastically, but it is of low repute in Denmark, the country in which Moellgaard introduced it in 1924 in the form of sanocrysin.

Sulphonamides indeed have been tried, given by intravenous drip, in a series of cases, but without result.[3] Hope was stirred when it was found that a compound

styled by its manufacturer "Promin," and chemically the sodium salt of diaminophenylsulphone didextrose sulphonate, proved to be effective in controlling experimentally-produced tubercular infections in guinea-pigs,[4] but it has been shown that Promin is a good deal more toxic for man than the guinea-pig, and moreover, produces a severe anæmia. It has been tried in pulmonary tuberculosis, given orally,[5] and by intravenous drip,[6] without appreciable result. Research, of course, is continuing.

It would seem likely, if anything comes of chemotherapy, that it might be expected to produce results in the early and predominantly exudative phase, where as yet tissue destruction and fibrosis have not taken place. It would be unwise to prophesy.

At the present time collapse therapy is the only proven and valuable form of active treatment for the progressive type of pulmonary tuberculosis associated with cavitation. It is true, however, that a number of pneumonectomies[7] and lobectomies have been done for massive cavitation not responding to surgical collapse, or for stenosed bronchi due to tuberculous ulceration, but on the whole the results have been disappointing. Some of these extirpations have been carried out because of mistaken diagnosis, the true tubercular nature of the lesion not being recognised beforehand. I have had one such case in which a diagnosis of pulmonary neoplasm was made after a very careful investigation, including numerous sputum examinations, bronchoscopy, and even thorascopy. A thoracotomy was carried out, and even then it seemed certain that the diagnosis of neoplasm was correct. An upper lobectomy was done successfully, and it was only established on examination of the specimen histologically, that the lesion was a tuberculoma. She is alive, well, and at work to-day, five years after the operation.

The outlook for the patient with a cavity and positive sputum is indeed a gloomy one. To illustrate just how gloomy: Clarke[8] published in 1934 a paper on the prognosis of pulmonary tuberculosis complicated by cavitation, showing that of 353 cavity cases, 66 per cent. were known to be dead in four years. More recently, in 1938, Brian Thompson[9] investigated the fate of 406 cases in an industrial area in Co. Durham: he says, "The early case-fatality was particularly striking: 42 per cent. of the patients dying within twelve months of diagnosis. At the end of the first five years three-quarters of the original total were dead, and of the survivors, half died within the second five years. In other words, of any eight patients with positive sputum, two would be expected to survive five years and one to survive ten years."

Such is the field for collapse therapy, and to make a case for it, or rather one form of collapse therapy, let me refer to a unique controlled experiment made by Freedlander[10] and Wolpaw of Cleveland, Ohio. Thoracoplasty was recommended for 143 patients, without knowledge of whether they would accept operation or not. Of these, 85 were operated on: 58 refused operation, but remained under observation and treatment in the sanatorium. The results were analysed at the end of three years.

143 PATIENTS.

85 accepted operation			58 refused operation	
Cavities closed	57%		10%	
Worse	7%	21%	35%	61%
Died	14%		26%	

Further subdivision was made into two groups.

GOOD CHRONICS.

43 Thoracoplasties			32 refusals	
Cavities closed	70%		16%	
Worse	2%	14%	19%	47%
Died	12%		28%	

SLIPPING CHRONICS.

42 Thoracoplasties			26 refusals	
Cavities closed	43%		4%	
Worse	12%	29%	42%	77%
Died	17%		35%	

Collapse therapy comprises a number of procedures: first and foremost, intrapleural pneumothorax, with its so frequently needed adjunct, closed internal pneumonolysis when pleural adhesions are present; extra pleural pneumothorax, which as now fallen into bad repute after a brilliant beginning; thoracoplasty; operations for interruption of the phrenic nerve, either temporary or permanent; plombage, now comparatively rarely used; and a new-comer, but really a very old method—cavity drainage (I have included this, as it appears to be mainly preparatory to thoracoplasty).

I propose to deal only with phrenic nerve operations, internal pneumonolysis, and thoracoplasty. Fortunately, I have not been concerned with the decision as to whether collapse therapy in the form of artificial pneumothorax should or should not be instituted, nor, as a rule, as to whether a phrenic nerve should be interrupted, although some consultation is often needed as to how it should be interrupted, as this has an important bearing on subsequent measures, such as thoracoplasty. Consultation about thoracoplasty is usual.

It might interest you at this stage to look back into the history of collapse therapy. It is a far cry to the year 1821, when James Carson[11] of Liverpool suggested collapsing the lung for hæmoptysis, and further indicated that the collapse should be by degrees. He even saw the possibility of bilateral collapse. Perhaps it was as well that his suggestions were neglected for sixty-one years, as Lister had not promulgated his antiseptic method until 1865. It was not till 1882 that Forlanini[11] of Pavia, stimulated by the recorded beneficial results in some cases of spontaneous pneumothorax, laid down the principles of artificial pneumothorax treatment. It was Potain,[12] however, who first used a closed pneumothorax for the arrest of pulmonary hæmorrhage. John B. Murphy[13] of Chicago had apparently realised independently the possibilities of pneumothorax, and published

a report in 1898, which stimulated Brauer of Germany; it is to him and to Saugman of Denmark that credit must be given for the dissemination of the principles of the therapy.

It is a curious thing that even to-day the real reasons for the beneficial effect of artificial pneumothorax are not completely understood.

The beneficial effect of artificial pneumothorax on the lung lesion, usually a cavitation, depends on the degree of collapse obtained. The ultimate aim is a selective collapse. Unfortunately, the ideal pneumothorax in which a complete anatomical collapse is achieved is not common, e.g., in 1940, of 163 cases in whom artificial pneumothorax was attempted at the Forster Green Hospital, 73 failed altogether, and only 37, i.e., 22 per cent., had a satisfactory collapse. It is hard to realise that adhesions between lung and chest wall vitiate the effect of pneumothorax to such an extent, and the procedure owes much to the genius of Hans Christian Jacobæus of Stockholm, who devised the method styled "closed internal pneumonolysis" for the division of such limiting tissue.

Jacobæus started by inspecting disease processes in the pleural cavity with the cystoscope and, having seen the adhesions, proceeded to work out a method of dividing them. His first paper on the subject was published in 1914, and the technique of the operation and its indications remain to-day much as he described them then. There has, of course, been much improvement in the tools, e.g., wider bore cannulæ and much improved optical systems.

Jacobæus died, rather suddenly I believe, towards the end of 1937 at the age of 58. I shall never forget his kindness to me in Stockholm. He was an amazing man, full of mental energy. It was delightful to see him try out on himself an apparatus for artificial respiration, which a young engineer had brought for his inspection.

Closed internal pneumonolysis is now regarded all over the world as an extremely valuable adjunct to artificial pneumothorax. Indeed here, it constitutes the major part of the surgical work done at two sanatoria.

Thoracoplasty.

While the principles of pneumothorax were being evolved, attention was being paid to the thoracic wall, and the first operations of a thoracoplastic type were done by de Cerenville[13] of Lausanne, who resected portions of the second and third ribs anteriorly, for apical cavities. He was followed in this by others: Garre, Quincke, and Spengler, but the results were not good, the amount of collapse being too small to allow the cavities to close. It was Brauer of Hamburg who first realised that what was needed was a collapse comparable to that obtainable by pneumothorax, and he got Friedrich in 1907, as I have already mentioned, to carry out the removal of all the ribs from two to nine inclusive—truly a heroic operation! yet the patient survived, and was much improved. It was soon realised, of course, that such operations were impossibly hazardous, because of shock and paradoxical movement of the chest wall.

A most important principle had, however, already been established by Boiffin[11]

and Gourdet of Nantes in 1895 : that resection paravertebrally of comparatively short lengths of rib effected a far greater reduction in size of the thoracic cavity than resection of much greater lengths in the antero-lateral region, and this principle as applied to pulmonary tuberculosis was first used by Wilms[11] of Heidelberg in 1911, when he removed paravertebrally portions of the first to eighth ribs inclusive. As shall be seen, Wilms had modern ideas, for he insisted on removal of part of the first rib : an essential : and sometimes carried out an apicolysis. I draw your attention to this, as it is a very usual feature in the modern operation. Sauerbruch (now in Berlin), about the same time, had evolved much the same paravertebral operation. Brauer,[14] however, still holding to his original idea that the healing effect of collapse on pulmonary lesions depended on the amount of the collapse, had evolved his subscapular paravertebral operation, in which much greater lengths of rib were removed than in the Wilms-Sauerbruch operation.

These operations—Brauer, Wilms-Sauerbruch—were standard more or less all over till about 1928. They were total thoracoplasties, and involved removal of parts of ribs from one to ten or eleven inclusive. They were often done in two stages. Sauerbruch,[15] moreover, insisted that the lower ribs be removed at the first stage, so as to minimise what he much feared, as everyone does, aspiration into the lower lobe. This was his standard operation, and which I saw him do in Berlin as late as 1938. Experience with the Wilms-Sauerbruch operation showed that only 36.8 per cent.[13] of patients were clinically cured, and the operative mortality was somewhere about 14 per cent. Brauer claimed, when I was with him, 50 per cent. cures, but I was never able to find out his mortality. It was probably higher than 14 per cent., as he preferred one-stage operations, so as to get a maximum collapse.

In an effort to improve these results, Alexander[13] and Graf independently in 1928 began to remove much greater lengths of the uppermost ribs than Brauer did. They resected the whole of the first rib and cartilage, and almost the whole of the second; and from the third to the seventh as far forward as required by the lesion. Alexander,[16] in 1925, had suggested the substitution of a partial thoracoplasty, if the lesion were essentially an upper one, for the total then in vogue. Resection of the ribs well medial to the transverse processes became a feature, as well as removal of the transverse processes themselves. It was recognised that even the partial thoracoplasty should be divided into stages, and, more recently, that not more than three ribs should be removed at each stage, and even, in the poor-conditioned patient, two only. Another very useful addition has been the formalinisation[17] of the rib beds, 10 per cent. formalin being used, to delay regeneration of bone between the stages. Zenker's[18] solution has been used for the same purpose, but it is probably not so effective as formalin.

If further collapse is required, it may be necessary to do an anterior stage, in which the costal cartilages and remaining portions of the second and third ribs are removed, and further, in the very difficult to collapse cavities in the gutter, it may be necessary to revise the posterior resection, removing the regenerated ribs which are always irregularly laid down and often fused : a very difficult operation !

Results have been produced showing that with this modern-type operation, a much higher proportion of cavities have been closed, and a much higher proportion of cases have healed sputum conversion, e.g., O'Brien,[19] with an operative mortality of 9.39 per cent., obtained cavity closure in 87 per cent. and sputum conversion in 81 per cent. Alexander[13] reported with 4.8 per cent. operative mortality, 83 per cent. with closed cavity and negative sputum.

Another addition to thoracoplasty has come from Norway, and it is, I think, a most important contribution. It is a procedure called by its chief originator, Carl Semb of Oslo, "extrafascial apicolysis." I heard him speak about it in 1935 at a meeting of the Tuberculosis Association in Oxford, and was so impressed that I went to Oslo that same year to learn more about it. Semb and Professor Holst had been working together to discover a good way of making thoracoplasty a selective operation, taking as model the selective collapse obtainable by a good pneumothorax; and ultimately evolved an apicolysis in which all the suspensory tissue suspending the apex to the vertebral column, plexus, and great vessels was divided. This involved division of bands of Sibson's fascia or Zuckerkandl-Sebileau bands, division of the periosteum of the upper three ribs and their intercostal vessels and nerves. All this is carried out in a plane outside the endothoracic fascia, as frequently the extrapleural plane is involved in a peripleuritis. Semb has shown extremely good results from this procedure, and although it may add considerably to the operating time required for a thoracoplasty, according to the difficulty of the dissection, the risks are not appreciably increased. It does, however, seem to be responsible for a higher incidence of atelectasis than the modern-type thoracoplasty I have described.[20]

Semb[21] was able to show in a series of 149 cases an operative mortality of 3 per cent., with closure of cavity and sputum conversion in 90 per cent.

Apicolysis has been fairly widely adopted. In Norway, or at least in Oslo, it was the standard operation at the beginning of the war, and Professor Holst, who is now in this country as chief of the Norwegian Medical Services, told me last year, that he was doing it in all thoracoplasties, and had even carried it out bilaterally in a few cases.

Such has been the evolution of thoracoplasty.

It is a procedure indicated in a relatively small number out of an average collection of cases of pulmonary tuberculosis. The percentage of 6.3 is given by Brooks and Lander of the Brompton Hospital (Brompton Hospital Reports, 1935). Alexander states that it was indicated in 10.3 per cent. of all the patients or in 13.1 per cent. of the collapse therapy group at the Michigan State Sanatorium.

Hitherto a trial of artificial pneumothorax has been the classical prerequisite for thoracoplasty, but there is a widespread opinion that thoracoplasty is to be regarded as a proper primary procedure in the case where there is a long-standing cavernous lesion with much fibrosis. In this sort of case it is very unlikely that a selective pneumothorax can be established and if a pneumothorax can be induced at all, it will probably be contra-selective, and therefore dangerous; so that the

patient may ultimately arrive at a thoracoplasty via an empyema—a longer and much more perilous journey!

Now, collapse therapy, which has for its objective the closure of cavities and conversion of sputum, has achieved these in a varying but fairly large proportion of cases, but unfortunately, the cavity sometimes, in spite of a seemingly perfect artificial pneumothorax or thoracoplasty, is quite uninfluenced or nearly so. It occasionally increases in size: a most baffling problem. Indeed, the "way of a cavity in the lung"[21] might well have been added to the four things, the ways of which Solomon said he knew not.

Lynn,[23] in artificial pneumothorax cases, has sometimes succeeded in getting a cavity closed by "fiddling with" the intrapleural pressure, and Clarke[24] has noticed in one case at least, that cavity closure was brought about by allowing a collapsed lung to expand! This has been commented on by others. Why should this happen? The answer, or at least part of it, seems to depend on what takes place at the junction of the cavity and bronchus.

A great deal of work has been done on this question by Pearson,[25] Eloesser,[26] Brunn,[27] Coryllos,[28], Monaldi, and others. Coryllos held that cavity closure follows complete blocking of the draining bronchus or bronchi (a large cavity may have many), and this has been supported by the autopsy findings of Auerbach[29] in thoracoplasty cases.

Eloesser has insisted on the importance of bronchial disease and stenosis in cavity formation and maintenance, the mechanism being that of a one-way valve, air being admitted to the cavity in inspiration, and its egress prevented, or made difficult by the further narrowing of the bronchial lumen occurring during expiration. (That a bronchus lengthens and widens during inspiration, and the reverse in expiration, was shown by Chevalier Jackson.[30])

These are tension cavities, and Eloesser has secured their closure by establishing external drainage by means of a turned-in skin-flap. Monaldi has done the same by suction drainage through a small tube introduced through the chest wall. It would not seem unreasonable, therefore, to expect, if bronchial drainage were efficient, without valve effect, that cavities would close, particularly when the force of the chest wall pull is eliminated or diminished by the establishment of a good pneumothorax or relaxed by a thoracoplasty.

Some cavities heal, but not many, under the usual bed-rest sanatorium treatment.

There is yet another method of cavity healing as has been shown by Pagel[21]:—epithelialization of its wall from the bronchial mucosa. In other words, it becomes a part of the bronchial system.

Such are some of the ways of a cavity.

Tracheo-Bronchial Disease.

Within the past few years a great deal of attention has been focussed on tuberculous lesions of the trachea and bronchi, and the importance of such lesions has come to be widely recognised. Alexander[31] states that "the recognition of tuberculous bronchitis as a relatively frequent complication of parenchymal pulmonary

tuberculosis (approximately 11 per cent.), is probably the most important advance that has been made in the field of tuberculosis during the past decade." The mechanical effect is obstruction by granulation tissue or œdema, and the problem is a major one when a major bronchus is involved. Suspicion as to the presence of such a lesion should be aroused when there is wheezing and more marked cough than one would expect, considering the size of the lung lesion; or when atelectasis is a feature in the X-ray film. It would appear, according to Badger,[32] that a fair number of cases of bronchial tuberculosis get well of themselves. Some, but not many, good results are claimed by the topical application of silver nitrate. More depends on the healing of the parenchymal lesions, and when collapse treatment is indicated for these, it has been shown that artificial pneumothorax is harmful. Thoracoplasty has given the best results.[33] Pneumonectomy has been done for the major stenoses, with but poor success. It is definitely indicated, however, for the tight undilatable stricture of a main bronchus when there is prolonged toxæmia, due to retention of pulmonary secretion from an atelectatic fibrotic lung, which may contain cavities and show bronchiestasis.[34]

I have had one such case in whom there was a tight fibrous stricture of the main bronchus. Its diameter was not more than two millimetres. It seemed to be an ideal case for pneumonectomy, but I could get no encouragement from several authorities in London whose advice I sought. A thoracoplasty was done, but she died of a hæmoptysis two years later.

In the diagnosis of these cases the bronchoscope is of paramount importance. Indeed some advocate and actually carry out bronchoscopy on all thoracoplasty patients before operation!

Jackson[35] used to say, "There are three ways of examining a lung. We may look at it from outside by inspection, palpation, and auscultation; we may look through it by means of X-ray; and we may look at it from inside by means of the bronchoscope."

The bronchoscope is certainly as indispensable to the thoracic surgeon as the cystoscope is to the urologist.

A review of the surgical work at the Forster Green Hospital has been made, covering the period 1932 till June, 1943. It comprises operations for interruption of the phrenic nerve, closed internal pneumonolysis, and thoracoplasty. The phrenic operations and internal pneumonolyses have all been carried out at the hospital; the thoracoplasties have been done almost wholly at the Royal Victoria Hospital.

I do not propose to enter into detail as to the phrenic operations. Dr. Clarke[36] and I published a paper on this subject in 1936, in which 316 cases were reviewed. The operations were all phrenic evulsions, and we came to certain conclusions, which still hold good when phrenic evulsion is indicated. Since that year a further 498 cases have been done, not all by me, bringing the total up to 814; many more phrenic crush interruptions have been done than evulsions, because evulsion is an irreversible procedure, and when the diaphragm is paralysed, there is a great risk of atelectasis of the lower lobe should a thoracoplasty be needed.

Unfortunately, crushing is not as effective as evulsion, in that the diaphragmatic

rise is not so high nor as certain, but a very interesting accessory measure—pneumo-peritoneum—has come to the fore recently, which very substantially increases the amount of rise. 800 to 1,000 c.c. of air are required, and refills have to be given once or twice weekly. I have seen X-ray films showing very good results, but have not myself carried out the procedure. It will probably remain in the hands of the physicians who carry out artificial pneumothorax.

After a phrenic crush, function returns to the diaphragm in from four to nine months.

The present position of the phrenic operation is :—

(1) Either crush or evulsion may be used at the termination of an artificial pneumothorax when it is considered unwise, because of extensive initial disease, to allow the lung to expand fully, in case of reactivation; or again if, after giving up an artificial pneumothorax, a high negative pressure in the pleura suggests that expansion will be incomplete. Here there is risk of pleural effusion.

(2) Evulsion may be used as an independent measure in the elderly patient, in whom other measures of collapse are contraindicated.

(3) Evulsion is sometimes useful for the relief of intractable cough, dragging pain, or dyspnœa.

(4) It is unwise to do anything other than a phrenic crush if a thoracoplasty is likely to be considered later.

On the whole, it may be said that phrenic interruption has proved to be a valuable procedure when used with the proper indications.

Closed Internal Pneumonolysis.

This is, of course, complementary to artificial pneumothorax in the effort to attain the ideal :—a selective collapse of the diseased part of a lung or lungs. That it has done this reasonably well, I hope to show.

I have made some inquiries as to the number of induced pneumothoraces in which it is required, and have found that the figure may vary from approximately 55 per cent. to 83 per cent. Gullbring of Stockholm has stated that it may be required in 60 per cent. to 81 per cent.

As cavitation is commonly found in the upper lobes of the lungs, so it is that by far the greatest number of adhesions limiting collapse are found in the apical region. The posterior and lateral regions are very common sites of such adhesions, and many are mediastinal. They present themselves in many forms, and vary enormously in extent and length and width. They may be like strings, bands, or webs of simple or complex pattern. The impossible one is the complete symphysis, in which a wide area of lung is "plastered" to the parietal pleura, e.g., the whole apex to the dome.

A great deal of information can be obtained from good X-ray films as to the situation, number, and probable operability of the adhesions. The usual A.P. film is, of course, indispensable, supplemented by oblique views frequently, but the final judgment rests on what the thoracoscope reveals. It is surprising how often what

appears to be radiologically a difficult or impossible case turns out to be quite reasonable from the operative aspect. The opposite, unfortunately, is found too, but not frequently.

It amounts to this, that inspection through a thorascope should not be withheld because of a dubious radiogram. A useful indication for thorascopy at least is a shift of the cavity from its original site when artificial pneumothorax is instituted.

As to when pneumonolysis should be undertaken after the establishment of artificial pneumothorax, the practice has been that six weeks after induction, all A.P. cases are radiographed; if adhesions are present limiting the collapse of a diseased part, pneumonolysis is done as soon as possible, except the patient is febrile, or in poor general condition, or if there is a rapid S.R., or if there is an effusion. In these, operation is delayed.

A small amount of effusion has not been regarded as a contra-indication if it is stationary. Women, if pregnant, have not usually been done. An extra pulmonary lesion is not necessarily deterrent. It may be an additional indication.

Pneumonolysis is regarded as a major surgical operation, and is carried out as such. It is done under local anæsthesia, with premedication in the form of injection of omnopon-scopalamine, on an operating table giving a good reversed Trendelenburg position. The two-cannulæ method is used exclusively, that for the thorascope being introduced through the fifth, sixth, or seventh intercostal space a little behind the situation of the angle of the scapula. The arm, of course, is well forward. In the early part of the work a mid-axillary puncture was used, as recommended by Maurer, but after seeing Gullbring's work, I adopted the posterior puncture. Brock[37] uses this site of puncture also. Only in a few occasions has another point of entry been necessary. There has been some controversy as to the relative merits of endothermic and galvano-cautery section of adhesions. I used, at the beginning, the endothermic method of division, but came quickly to the conclusion that cautery section was much the superior, and think that more critical work can be done in safety with it close to the great vessels, and in other awkward places, than with diathermy, which requires pleural anæsthesia. I have found, when it has been necessary to enucleate a broad adhesion or adhesion complex from the chest wall, the dissection being done outside the pleura and endothoracic fascia, that this can be accomplished without the aid of diathermy. Maurer makes a special point as to diathermy in this type of adhesion, although for the actual division he uses the galvano-cautery. His diathermy current is a highly-damped coagulating one.

The operation has been relatively easy in some cases, and has been carried out in a quarter of an hour, but in a large number it has been difficult, and in some hazardous, requiring much time and patience. The strait between the Scylla of a perforated lung and the Charybdis of a troublesome or serious hæmorrhage is truly sometimes very narrow, and requires careful navigation. It often is impassable.

It is vital to recognise how far peripherally lung tissue extends in an adhesion, division of which is contemplated. It may extend right to the chest wall and its division, by enucleation, only possible by reason of a measure of tenting of the

parietal pleura. However, with all its difficulties and hazards, pneumonolysis is a relatively benign procedure.

It has been carried out up till June, 1943, on 395 patients: 376 of them were unilateral cases; 19 were bilateral cases, requiring operation on both sides, so that 414 pneumonolyses were carried out. A few cases had more than one seance, but these have not been counted as additional operations, nor has simple thoracoscopy been included.

The results of these operations have been analysed as to the anatomical effect: complete or incomplete, and also as to the functional effect: successful or unsuccessful. They fall into four groups, because some complete anatomical collapses had not a successful functional result, and some incomplete anatomical collapses had a successful functional result.

(Complete anatomical indicates hilar collapse, all adhesions being divided. Successful functional indicates closure of cavity and sputum conversion.)

TABLE 1

CLOSED INTERNAL PNEUMONOLYSIS.

Group I	Group II	Group III	Group IV	Total
Complete	Complete	Incomplete	Incomplete	
Satisfactory	Unsatisfactory	Satisfactory	Unsatisfactory	
213	48	95	58	414

ANALYSIS OF GROUP II (48 Cases)

Contralateral A.P. - - - -	6
Lesion remained stationary - - -	7
Contralateral lung broke down - -	19
Dead (42.8 per cent.) - - -	18

TABLE 2

CLOSED INTERNAL PNEUMONOLYSIS.
(414 Operations)

ANATOMICAL RESULT.

	Complete	Incomplete	Total
Number - -	261	153	414
Per cent. - -	63	37	

FUNCTIONAL RESULT.

Number - -	308	106	414
Per cent. - -	74.6	25.4	

It will be seen from Table 1 that, in spite of a complete anatomical collapse, 48 were unsuccessful functionally, i.e., cavity remained open and sputum +. It also shows that in the incomplete groups 95 were successful functionally. The poor functional result in group II, in spite of complete collapse, may have been due to thick-walled cavity, or partially-blocked cavity, or acuteness of the disease, for on analysis of these 48 it was found that 6 already had a contralateral A.P.; the lesion

remained stationary in 7, the contralateral lung broke down in 19, and 18 of the patients, amounting to 42.8 per cent., are dead, the mortality being much higher than in group IV (incomplete anatomical, unsuccessful functional), which one would expect to show the worst mortality figure, but the figure in this was actually 28.3 per cent., as will be seen in another table (Table 7).

Further evidence of this was obtained from an analysis of the commonest complication of pneumonolysis : effusion, or rather the persistent effusion : persistent meaning that it remains longer than six weeks.

TABLE 3

EFFUSIONS COMPLICATING PNEUMONOLYSIS—Total = 109.

	Complete	Incomplete	Total
Successful - - - -	213 (38)	95 (23)	308 (61)
Percentage of persistent effusion -	17.6	24.2	19
Unsuccessful - - - -	48 (25)	58 (23)	106 (48)
Percentage of persistent effusion -	52	40	45

Number of effusions in brackets.

This shows that 52 per cent. effusions occurred in the unsuccessful complete group, against 17.6 per cent. in the successful complete group.

It will be seen in Table 3 that 95 of the incomplete had a successful functional result, and that 58 had an unsuccessful result. This will be seen to depend a good deal on the situation of the adhesions remaining undivided. I have shown in Table 4 the incomplete groups, i.e., III and IV, and the position of the remaining adhesions.

TABLE 4

POSITION OF REMAINING ADHESIONS.

Incomplete Anatomical Collapse Groups	Group III 95	Mediastinal -	60	63.2%		
		Apical - -	34	35.7%	}	36.7%
		Others - -	1	1 %	}	
	Group IV 58	Mediastinal -	26	44.8%		
		Apical - -	22	37.9%	}	55.2%
		Others - -	10	17.3%	}	

Shows predominance of mediastinal adhesions in the successful functional group, i.e., group III.

Showing that there is a reasonably good chance, if the adhesions remaining are only mediastinal, of obtaining a successful functional result.

This would indicate that it is not wise to do a risky dissection or division of mediastinal, or medial apical adhesions, particularly the mediastinal, in the effort to get a complete anatomical collapse, as a good percentage of such will have a successful functional result. Edwards[38] and Lynn have also pointed this out.

Supplemental measures have been carried out in the unsuccessful functional groups in the endeavour to improve the results.

TABLE 5

PHRENIC OPERATIONS IN PNEUMONOLYSIS CASES.
47 in unsuccessful functional Groups II and IV.
4 at the termination of A.P. in Groups I and III.

Group II (48) - - - 19 (complete : unsuccessful)	7 = 37% with good result	i.e., successful functional.
	12 = 63% with poor result	
Group IV (95) - - - 28 (incomplete : unsuccessful)	14 = 50% with good result	i.e., successful functional.
	14 = 50% with poor result	

Comparing the phrenic results in Groups II and IV, the poor result in Group II is probably due to the inherent intrapulmonary factors, e.g., blocked cavity, etc., whereas in Group IV it would seem that the remaining adhesions are the sole bar to a successful result, i.e., an extra-pulmonary cause.

Groups I and III (successful functional) : 4 phrenics done between two and a half and three years after operation, when A.P. was abandoned.

COMPLICATIONS.

As to the complications of the operation, the most common was effusion. I have divided effusions into those that were transient and those that were persistent. Any effusion seen on screening the patient within six weeks of the operation was put down as a complication, provided it was sufficient to cover the dome of the diaphragm. Some cases had small effusions before operation, but I am unable to state just how many. At any rate, there were 88, or 21.3 per cent., which were transient, i.e., not lasting longer than six weeks. Those which remained longer than six weeks were labelled persistent. There were 109 of these, i.e., 26 per cent., and the striking thing, as I have already indicated, is that the incidence was so much higher in the unsuccessful functional groups, 45 per cent. as against 19 per cent. in the successful functional groups, and it was higher actually in the complete anatomical subdivision of unsuccessful result than in the incomplete—52 per cent. against 40 per cent (Table 3).

A persistent effusion very frequently leads to abandonment of the artificial pneumothorax, because of obliteration of the pleural space. This has happened in 69 cases. It was found possible to continue the A.P. in 37.

Now it is well known that artificial pneumothorax itself is complicated by the occurrence of a considerable number of effusions or benign empyemata, and it does not seem possible to make a clear-cut division between these.[40] Tubercle bacilli can be demonstrated in most—if not all—of them by suitable methods. The frequency of effusion in artificial pneumothorax appears to be in the neighbourhood of 50 per cent., so it would not seem that the incidence of 26 per cent. of persistent effusion is out of the way. Indeed, considering the number of cases in which one sees through the thoracoscope tubercles often in large numbers under the visceral pleura of a diseased lung, it is surprising that complications are not more frequent than they are.

Clifford Hoyle[41] has said that the risk of empyema as a complication of adhesion section is far less, in skilled hands, than the risk from this source if adhesions are left untouched, and Eric Jonsson[42] of Soderby Hospital, Stockholm, in a study of empyema during pneumothorax, remarks about cauterization of adhesions, that the mortality, when cauterization was done, was considerably less than when it was not done. His explanation is that cauterization yields a better collapse, obviating thereby the spread of infection to the other lung.

In addition to the effusions, other complications were: seven hæmorrhagic effusions, one staphylococcal empyema, and one perforation of the lung. None of the hæmorrhagic cases was fatal: indeed four are very well from three and a half to ten years later.

The only really serious complications were the lung rupture, as he was a bilateral case, and the pyogenic infection of the pleura.

TABLE 6

COMPLICATIONS: CLOSED INTERNAL PNEUMONOLYSIS 414

Effusions - - 26%		
Hæmorrhage - 7	4	alive and well from three and a half to ten years after.
	1	(first case done) died seven years after (diss. scler.)
	1	in hospital: has some effusion.
	1	not traced.
Staphylococcal empyema - 1	An extensive dissection. Two days after operation, trace of fluid. Later aspiration of yellow fluid—sterile. Hectic temperature. Chest aspirated. 67 oz. purulent fluid. Closed drain two months later. Discharged four months later very ill. Died later.	
Perforation of lung - - 1	Was a bilateral A.P. Contralateral side obliterating—fluid. Operation in two seances: 8/1/37, 18/1/37. Result of operations—incomplete. Condition fairly good until sixth day—dyspnœa, pain, semi-conscious. Air withdrawn continuously—needle in situ. Died thirteenth day.	

I have tabulated the unilateral patients (376) in their groups as regards the anatomical and functional results, and have indicated what has happened to them (Table 7).

TABLE 7

UNILATERAL INTERNAL PNEUMONOLYSES

(376 patients)

	Group I—191		Group II—42		Group III—90		Group IV—53		
	Comp. Anat. Succ. Funct.		Comp. Anat. Unsucc. Funct.		Incomp. Anat. Unsucc. Funct.		Incomp. Anat. Succ. Funct.		TOTAL
Working	142	74.3%	*12	28.6%	63	70%	†16	30.2%	233
Dead	13	6.8%	18	42.8%	9	10%	15	28.3%	55
Active	12	6.3%	8	19.1%	4	4.4%	14	26.4%	38

	Comp. Anat. Succ.	Comp. Anat. Funct.	Comp. Anat. Unsucc.	Comp. Anat. Funct.	Incomp. Anat. Unsucc.	Incomp. Anat. Funct.	Incomp. Anat. Succ.	Incomp. Anat. Funct.	Total
Not traced	6	3.1%	—		2	2.2%	2	3.7%	10
In hospital	13	6.8%	4	9.5%	6	6.7%	6	11.4%	29
Alive and well, not working	4	2.1%	—		6	6.7%	—		10
Dead, other causes	1	.6%	—		—		—		1
Total	191		42		90		53		376

*12 S.C. After phrenic E. - 7; After thoracoplasty - 1; After I.P. - - - 4

†16 S.C. After phrenic - 13; Without phrenic - 3

The gratifying thing to be noted from the above table is that 64.6 per cent. are capable of work—233, or 60 per cent., being actually at work.

As to bilateral internal pneumonolysis, 38 of these were done in 19 patients

TABLE 8

BILATERAL INTERNAL PNEUMONOLYSES - 38

(19 patients)

Alive and well and working -	8	In 6 patients: {comp. anat. / succ. funct.} on both sides
		In 2 patients: {incom. anat. / succ. funct.} one side and {comp. anat. / succ. funct.} one side
Dead - - - - -	7	
Active - - - - -	1	
Alive and well, but not working -	1	
In hospital - - - -	2	

Bilateral cavitation, untreated, carried probably a 95 per cent. mortality over a five-year survey.

Looking back over the results of internal pneumonolysis, it is not too much to claim that the procedure has increased the effectiveness of pneumothorax treatment very considerably, and, moreover, without much risk.

THORACOPLASTY.

The material I will present to you comprises 78 patients. In 70 thoracoplasty was done because of pulmonary lesions—cavitation in all but 3, in whom there were infiltrative changes with a positive sputum. The cavity was not demonstrable. Two had cavitation, but a negative sputum. Eight thoracoplasties were done for empyema.

The indications for operation in the pulmonary cases were the accepted cavitation and positive sputum; evidence of productive lesion; mainly unilateral; general condition reasonably good; A.P. failed.

As regards the contralateral lungs, 26 showed no disease; 39 had evidence of disease, but inactive; 5 had some evidence of active disease.

They have been divided into three groups, indicating in a general way the course of the disease :—

Good chronic	-	-	17 cases
Relapsing chronic	-	-	28 ,,
Slipping chronic	-	-	20 ,,

This classification has been used by Freedlander[10] and Wolpaw, and Price Thomas[43] of London.

Good chronic indicates : no clinical evidence of activity except positive sputum and cavity. A low S.R.

Relapsing chronic indicates : periodic exacerbations in a good chronic case. Raised S.R. during exacerbation.

Slipping chronic indicates : definitely progressive disease. Raised S.R. 15 or over (Cutler).

At first a few total thoracoplasties were done in one stage after the Brauer fashion, but very soon, i.e., from 1933 onwards, the operations were done in stages, usually two, the extent of the resection being determined by the level of the lesion. It was usual to do, in the first stage, removal of the upper four or five ribs, although in some of the total thoracoplasties the lower ribs were done first after Sauerbruch.

Since 1935, I have adopted the type of partial thoracoplasty that has been already indicated as the "modern operation," but have not been removing the transverse processes, except in a few cases obviously requiring the maximum collapse. I have, however, followed the Norwegian practice of dividing the ribs far medial to the tip of the transverse processes after dividing the costo-transverse ligaments. The Semb apicolysis has been used rather cautiously, in view of the excellent results reported following the modern type partial thoracoplasty, in which apicolysis is not done, but of recent years I have been doing much more of it. When apicolysis has not been done, an attempt to delay regeneration of the ribs has been made by treating the rib periosteum with 10 per cent. formalin; earlier, Zenker's solution was used for this purpose. Formalin seems to have a better effect and, at any rate, is not so messy in the wound, although I cannot recall any ill effect on wound healing from the use of Zenker.

The operations in this group of 78 patients have been carried out under general anæsthesia. Up till about three years ago chloroform, with oxygen, was the anæsthetic agent, with which a paravertebral region anæsthesia with novocain was combined. Nitrous oxide I have never liked for thoracoplasty cases, as it causes a much too laboured respiratory action and usually, in order to get reasonable anæsthesia, the oxygen percentage may be too low. Lately, I have found that either a nitrous oxide, oxygen, ether combination, or cyclopropane and oxygen is very suitable.

In Norway, I saw Holst and Semb do all their thoracoplasties under local anæsthesia entirely, and very recently I have done several cases with plexus block

and paravertebral regional anæsthesia, combined with local infiltration of the wound. These were perfectly satisfactory from the anæsthetic point of view, but I could not help being rather sorry for the patients, who must have been aware, to some extent at least, of what was going on, and as well, were condemned to a pretty uncomfortable position for a long time.

Intravenous glucose saline has been freely used post-operatively. Only occasionally has blood transfusion been required.

Drainage of the wounds has not been done for a number of years, and I have the impression, in spite of adverse comment on its use, that sulphonamide "frosting" of the wound has produced a more kindly healing.

There were seven post-operative deaths, and Table 9 shows how they are related to the groups.

TABLE 9

THORACOPLASTY—POST-OPERATIVE COMPLICATIONS.

Deaths - 7

GROUPING OF CASES		Deaths		Phrenic	CAUSE OF DEATH
Good chronic - -	17	1	R	Yes	Pulmonary embolus 13th day.
Relapsing chronic -	28	1	R	Yes	Atelectasis. Toxic liver and spleen.
Slipping chronic - -	20	4	R	Yes	Asphyxia. Too large a resection. 7-rib one-stage.
			R	Yes	Pneumonia (?) atelectasis after 2nd-stage 10-rib op. Much difficulty with sput.
			R	Yes	Atelectasis. An acute case, probably unsuitable for thoracoplasty.
			L	No	Streptococcal septicæmia (hæmolytic).
No cavity, sputum + -	3	1	R	No	(?) Meningitis.
Cavity, sputum – -	2	0			
Empyema - - -	8	0			

One occurred in the "good chronic" group; one in the "relapsing chronic"; four in the "slipping chronic"; and one in the "no cavity sputum + group." None occurred in the cavity : sputum – and empyema groups.

The first death in the good chronic group occurred in 1942. She had a three-year history. A phrenic evulsion had been done previously. The operation was a first-stage removal of four ribs on the right side. The feature about her afterwards was a rather rapid pulse, sometimes as high as 150. She died on the 13th day, the cause of death being pulmonary embolus.

The first death in the relapsing chronic group also occurred in 1942, two days after a first-stage five-rib operation on right side. She had had a previous phrenic evulsion. Post-mortem examination showed severe atelectasis of the right lung, and congestion with œdema of left lung. Toxic changes in liver and spleen were also found.

In the slipping chronic group there were four deaths :—

(1) Large cavity right infraclavicular region. Healed lesion left side middle third. Had phrenic evulsion operation one-stage (seven-rib) 1933 . Cyanosis noted post-operatively. Pulse poor. Was very dyspnœic next day. Died on second day. Asphyxia.

(2) Three large cavities right apex, right infraclavicular region, and right middle zone. S.R. (Cutler) 26. Healed lesion on left side. Had right phrenic evulsion. Operation January, 1935. First stage, ribs five to ten resected, i.e., lower ribs done first. Thirteen days later second stage, ribs one to four resected. Post-operatively there was much difficulty in expectorating. Condition suddenly got worse, four days later, and he died. Post-mortem showed pneumonia left lung. In the right lung there was much purulent material in the bronchioles.

(3) Had a moderate-sized cavity one inch below right apex. Had phrenic evulsion. Died second day after operation, which was of the Brauer type. Had dyspnœa afterwards and could not raise his sputum satisfactorily. It was abundant. Intravenous fluids produced no effect. Post-mortem showed subacute pulmonary disease with cavitation. Right lower lobe collapsed. Atelectatic. Degenerative changes in liver, kidneys, and myocardium.

He was really an acute case, and probably should not have been considered for thoracoplasty. He was most apprehensive, and before he entered hospital, sold his farm.

(4) He was a very dubious case for thoracoplasty, and had an extremely bad resistance to infection. He had been in two Dublin hospitals in 1935.

In Forster Green Hospital a right artificial pneumothorax was done, and kept up for thirteen months. Then a left artificial pneumothorax was tried in 1937, but it was unsuccessful. Operation was a first-stage five-rib one. After operation a hæmolytic streptococcal wound infection (the only serious infection in the series). He died, apparently from a septicæmia.

One other death occurred in the no cavity sputum + group. Phrenic operation had not been done. He was febrile after the operation, in which five ribs were removed. Four days before death, which took place twenty-two days post-operatively, he complained of blurring of vision and some stiffness of the neck. Lumbar puncture yielded only a yellowish C.S.F. He became delirious before death. Death was probably due to meningitis. It was not confirmed post-mortem.

On analysing these deaths, it is very remarkable that six of the patients had

right-sided operations. Only one was on the left side. It has long been known that the operative mortality of right-sided thoracoplasty is higher than left-sided. Many have commented on this; Livingstone, in the Brompton Hospital Reports (1936), states that it is about 50 per cent. higher. The explanation would seem to be that the right heart and great veins are more susceptible to altered intrathoracic pressure than the left heart and aorta.

The other remarkable feature is that five of the patients had had phrenic evulsion prior to thoracoplasty. It is probable that the paralysis of the diaphragm played a great part in the production of the atelectasis, which was found post-mortem in three, and in the anoxæmia of another.

A most serious occurrence, after a thoracoplasty operation, is bronchial obstruction by accumulation of secretion. The influence of phrenic interruption on this may be explained in the following way: After a thoracoplasty the bronchial secretion in most cases is increased, some of it, of course, comes from the cavity. If at the same time cough and expectoration are diminished, as they are because of pain, accumulation of secretion occurs, and serious results may follow. The bronchi of both operated and good lungs may be so blocked that a fatal asphyxia supervenes—"drowned lung." Obstruction of the main bronchus, or lower lobe bronchus, of the operated side only, causes total or lobar atelectasis respectively. A lesser degree of atelectasis—lobular—arises from obstruction of smaller bronchi. Now, cough and expectoration are produced by forceful expiratory effort, which cannot take place without preceding inspiration. It is this—inspiration—necessarily interfered with by a certain amount of paradoxical movement in the decostalized part of the chest wall, which is further deranged by a paralysed hemi-diaphragm, the result of phrenic interruption.

Post-operative atelectasis is a very difficult condition to recognise in a thoracoplasty patient. It may be suspected on clinical grounds, but it can only be established radiologically. The radiogram shows a uniform density of the whole of the non-collapsed portion of the lung, with displacement of the heart and mediastinum towards the involved side.

Holst, Semb, and Frimann-Dahl, in their study of atelectasis in thoracoplasty, state that "investigations distinctly show that active mobility of the diaphragm plays an exceedingly important part with regard to the occurrence of post-operative atelectasis in thoracoplasty. Suspended active mobility of the diaphragm increases the danger of atelectasis." They found that phrenicectomy approximately doubled the number of atelectases. They also think that atelectasis has an important relationship to pneumonia: precedes it.

There is no doubt that if a lobe remains atelectatic for any length of time, it is likely that spread of the tuberculous process will take place in it, and probably fresh cavitation.

Results of Thoracoplasty.

The results of thoracoplasty have been tabulated in Table 10.

TABLE 10

RESULTS OF THORACOPLASTY.

78 Cases (including empyema).

	Funct. Result S.C.	Post-Op. Deaths	Fit for work or at work	Not working fair health	Poor Health	Late Deaths	Not Traced
17 Good chronic -	13	1	10	3	1	1	1
28 Relapsing chronic -	14	1	15	4	—	7	1
20 Slipping chronic -	6	4	6	3	1	6	—
3 No cavity, sputum -	2	1	2	—	—	0	—
2 Cavity, sputum – -	1	0	1	—	1	0	—
8 Empyema - -	7	0	7	—	1	0	—
	43	7	41	10	4	14	(11 tubercular).
	55.1%	9%	53%				

S.C. = Satisfactory collapse, i.e., cavity closed, sputum negative.

Empyema 8 { 6 Tuberculous empyemata—3 with bronchial fistula.
1 Staphylococcal empyema.
1 Bacteriology—uncertain.

TABLE 11

THORACOPLASTY - 78.

Post-operative deaths - -	7 = 9%	
Late T.B. deaths - -	11 = 14%	
Non-tuberculous deaths -	2	
Doubtful - - -	1	? Meningitis.
		? Cerebral Tumour.
		Tuberculoma.
Total deaths - - -	21 = 27%	
Alive - - -	55 = 70%	(2 not traced).
Fit for work - - -	41 = 53%	

DISCUSSION.

I am not very proud of these thoracoplasty results, in view of the very much better figures produced by others. In the first place, a 9 per cent. mortality is much too high, and in the second, the operations have not produced a great enough number of satisfactory collapses.

As regards operative mortality, it has been realised that too much was being done at each stage in the way of numbers of ribs resected. Four ribs at a first stage was quite usual, and often five or six and even seven have been removed. The greater resections were, of course, in the early cases, when it was not realised how dangerous paradoxical movements of the chest wall could be; the resections in the early cases were fairly extensive, after the Brauer fashion. Phrenic evulsion,

prior to operation, was undoubtedly an important factor too, so that now, if a phrenic operation should be required to make a patient fit for thoracoplasty, one is very careful to see that it is a temporary interruption.

Alexander[45] has said recently that the most important factor in preventing death as a result of thoracoplasty, is the consistent performance of small operative stages, of not more than two ribs per stage, in the large majority of the cases. This may be somewhat too strict, however, except in the "very poor risk" patient.

Regarding the functional results of thoracoplasty, the effectiveness of the operation is judged by cavity closure and sputum conversion. In the good chronic group, the result has been reasonably good, 81 per cent. (13 in 16) having a satisfactory collapse. In the relapsing chronic, only 51 per cent. (14 in 27), and in the slipping chronic 37.5 per cent. (6 in 16) showed a satisfactory collapse. Too many have remained unsatisfactory, and this is confirmed by the late tubercular deaths, some of these, however, not occurring for as long as six and seven years. These results are not good enough.

It is difficult often to determine whether a cavity is closed or not, as the thoracoplasty side is so dense that a cavity may be present and is not shown up by the ordinary standard chest technique. It is now realised that more highly penetrative rays must be used, and with a Potter-Bucky diaphragm. Continuation of a positive sputum is always suggestive of an open cavity.

At present careful radiological examination with Potter-Bucky technique is carried out after each operative stage, to determine what is happening, so that there should be nothing neglected in the effort to gain a satisfactory result, e.g., it may be seen that a greater amount of rib removal or an anterior stage is required; sometimes a revision posteriorly is needed.

Another difficulty has been that when a thoracoplasty patient leaves hospital, he or she may not be seen for a long time, quite unlike the A.P. patients, who have to report at short intervals for refills.

There is one gratifying feature about these thoracoplasty results: 53 per cent. of the total is fit for or is at work.

In the preparation of this oration I have been under obligation to many.

I would gratefully acknowledge my indebtedness in particular to Dr. Maybin of the Forster Green Hospital. Without her help I simply could not have managed the work. She has spent endless hours in looking up and classifying the cases.

Dr. Lynn, the medical superintendent of the Hospital, has given me much valuable advice, as has also Dr. Clarke, who was formerly its medical superintendent.

I should like to thank also Mr. David Mahaffy of the Royal Victoria Hospital for the very excellent lantern slides he has made.

In conclusion, I should like to express my thanks to the Committee of the Campbell Memorial Fund for the opportunity they have given me to pay a tribute to the memory of my old and much revered chief. I only wish it had been a better one and more worthy of him.

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The History of the Belfast School of Ophthalmology and Oto-Laryngology

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Presidential Address to Belfast Medical Students' Association

THERE is a quotation from Kipling which runs :—

"God gives all men the earth to love,
But since man's heart is small,
Ordains for each one spot shall prove
Beloved over All."

So to-night I propose to give you the history of the Belfast School of Ophthalmology and Oto-Laryngology, the Hospitals comprising it and the men who have made it, also my own personal view as to its future as seen from (1943) to-day.

Looking back one hundred years, as it was about that time (1845) that the Belfast Ophthalmic Institute was established, one must remember that even the epic discoveries of Lister and Pasteur were still unknown, and so Medicine, as we know it to-day, was still in a very embryonic state. Also, the industrial era had not arrived in Belfast and the population of the town was then only about 85,000 people. To-day our city has a population of almost 500,000 persons, i.e., the population has increased sixfold. At the present time the hospital accommodation in our branch consists of the two special Hospitals, popularly known as The Ophthalmic and The Benn, and of our special departments in the three general and two Children's Hospitals.

The first attempt to organise an eye dispensary in Belfast was made in 1816, but it was 1827 before success prevailed. Twelve years later the dispensary was closed for reasons now unknown.

In 1845, i.e., about one hundred years ago, The Belfast Ophthalmic Institute was established in a house at 35 Mill Street, Belfast, by Dr. Samuel Browne, R.N., J.P., and a few of his friends. Some years later, in 1858, they removed to Donegall Square Mews, and three years later to Howard Street.

The attendance was about one thousand per annum, of which it is said two per cent. were cataract cases, and a permanent relief was obtained in sixty per cent. of the cases. About ten per cent. of the cases were ear cases. The expenses of each patient was said to be eightpence.

This enterprising institution was obviously appreciated, for the Belfast Sanitary Committee granted Dr. Browne a grant, and recorded: "We deem it just to add that already its reputation has spread far and wide over the Province." This was a just compliment to the deserving management.

The present Belfast Ophthalmic Hospital was founded in 1867 by Lady Johnson, who gave £3,000 in memory of her father, Thomas Hughes, and also an additional £2,000 for endowment purposes.

Sir Thomas Houston informs me that in the early days of this Hospital the whole intern staff consisted of a caretaker and his wife. The latter was sole nurse of the establishment.

Since the foundation of the Hospital, about £12,000 has been spent in carrying out alterations and extensions. To-day the Hospital can accommodate thirty in-patients as well as running a large out-patient department.

Dr. Samuel Browne, who was its first surgeon, must have been a man of many parts, for in 1870 he was Mayor of Belfast. In 1880 his son, Dr. John Walton Browne, became assistant surgeon, and seven years later was made a full surgeon.

Before joining the Belfast Ophthalmic Hospital, Walton Browne was on the staff of the Royal Hospital as a general surgeon, and continued in this capacity until reaching the retiring age. In 1881 he was a candidate for the Chair of Surgery at Queen's College, and although unsuccessful, his candidature was supported by a memorial signed by 237 graduates and 63 senior students; the memorial read: "That owing to Dr. Browne's popularity as a teacher in surgery and his success as one of the most brilliant and dexterous operators in the North of Ireland, his appointment to the Chair of Surgery would be of great benefit to the Belfast Medical School."

Walton Browne was one of the leading medical men of his day. He had a commanding presence, a cultured style, and a manner that never failed to inspire confidence. In 1921 he was knighted by H.M. the King, much to the delight of his many friends. He held very strong views on all matters affecting the medical profession and was often outspoken in his comments. His presidential address to the Ulster Medical Society in 1880 was entitled "Chloroform and Ether: Their Advantages and Disadvantages." Being a firm believer in chloroform, he summed up his remarks in saying: "It is not the chloroform that is to blame for fatalities, but its mode of administration." It was a few years later on that local anæsthesia was first introduced by Koller, an Austrian surgeon, who had discovered cocaine. The discovery of adrenalin by Professor Takamine of Japan was about the same time.

Walton Browne continued as surgeon to this Hospital until his death in 1923. In one of the last medical reports he read he states: "Nothing would afford me greater pleasure than to see established in Belfast an eye hospital worthy of the city and the North of Ireland. In every large centre in England and Scotland there was a fully equipped eye hospital, and I do not see why in the course of time they should not have a large ophthalmic hospital in Belfast."

He said: "Most people had a hobby, and I hope in the remaining years of my life to make this Hospital my hobby." He was hoping that someone might come to their aid in this matter in the same way as Lady Pirrie came to the aid of the Royal Victoria Hospital. For over fifty years Sir John gave his services to the Belfast Ophthalmic Hospital and to the Royal Victoria Hospital, and these Hospitals, which he made his hobby, will eventually benefit from a large bequest he has made to them.

It is not only the medical men who have given long and faithful service to our Hospital. For instance, the present chairman of the Belfast Ophthalmic Hospital, Sir J. Milne Barbour, has been a member of the Board of Management for almost twenty-five years, and Mr. J. McC. Loewenthal for about thirty years. Sir Thomas Somerset, M.P., took over the treasurership and a debit balance about twenty-five years ago, and through his efforts the finances of the Hospital are now in a very satisfactory position. Other outstanding medical men connected with this Hospital were Dr. Cecil Shaw and Dr. Wiclif McCready. Shaw was appointed in 1895 and served on the staff until his death in 1913. He was also on the staff of the Mater Infirmorum Hospital and Lecturer in Ophthalmology and Otology at Queen's University. His text-book on Ophthalmology was very popular with the students of the day.

Dr. Wiclif McCready joined the staff of the Hospital in 1911. Three years later at the outbreak of war he first commanded an infantry company in one of the battalions of the newly-formed Ulster Division. After the Battle of the Somme, however, he was transferred to the Medical Corps as an ophthalmic specialist. In the immediate post-war period he was the mainstay of the Hospital and a strong outstanding personality. He was not only a good surgeon, but also a good teacher. It was a sad blow to me when in 1933 he was forced to retire owing to ill-health, as he had been my sponsor, good friend, and wise counsellor.

The Ulster Eye, Ear, Nose and Throat Hospital was founded in 1871 in temporary premises at 7 Great Patrick Street, Belfast. About 1900 its name was changed to Benn Ulster Eye, Ear, Nose and Throat Hospital, presumably to commemorate the name of Edward Benn of Glenravel House, who bore the whole cost of erecting the original hospital on its present site, at the corner of Clifton Street and Glenravel Street. The Hospital was opened in 1874—the cost being £3,180. The Benn family also built the Skin Hospital next door to the Eye and Ear Hospital, as well as the Samaritan Hospital on the Lisburn Road.

It is interesting to note that in the first hospital report published in 1875, the President of Queen's College, Belfast (Rev. Dr. Henry), stated that in his opinion an amalgamation with the Belfast Ophthalmic Institute would impair the general usefulness of the two Hospitals. The area of operations and the population are sufficiently large for both; the boards, managers, and officers are all earnest, and impelled by the legitimate rivalry of benevolence and good works, and the subscribers have their option of contributing to one or both according to their desires or circumstances. Therefore let both flourish.

This Hospital had as its first surgeon Dr. William A. McKeown, a man of great originality and great character. He was the first surgeon in Belfast to practise ophthalmology and oto-largngology exclusively. His reputation was world-wide among ophthalmic surgeons for introducing two outstanding and original methods of treatment. In 1873 it was he who first utilised the principle of the magnet for extracting metal which had penetrated into the eyeball. The magnet had been used for the removal of metal from the superficial parts of the eye from earliest times, but Dr. McKeown was the first person to make a surgical incision into the eyeball and then use the magnet. I believe the first case in the world in which this operation was performed was in the Benn Hospital on a lad from Harland & Wolff's shipyard. Three years later this method was further developed by Professor Julius Hirschberg of Berlin by the introduction of the electro-magnet. As you know, these powerful electro-magnets are still used for this purpose all over the world to-day.

In 1884 Dr. McKeown devised a new technique for the removal of cataract. Up till then patients suffering from this condition were allowed to become totally blind before the removal of the opaque lens was undertaken. By means of a fine needle he injected a few drops of water below the capsule of the lens, and thus the cataract was brought to maturity; the operation could then be performed in a short time, and so the patient was saved many weary months of waiting. He also devised a method for irrigation of the anterior chamber of the eyeball after removal of the lens. He wrote a book describing the technique of the operation, which gained for him a wide reputation both in Europe and America.

A paper describing his methods was published in the "Lancet" in 1889, and these facts are also recorded in the American and French Encyclopædias of Ophthalmology. In 1882-83 he was President of the Ulster Medical Society.

Dr. McKeown's interest was not only in university education, but being a public-spirited citizen he believed in educating the community.

In 1895, among the prevalent causes of blindness in Belfast at that time, he stresses :—

1. Purulent ophthalmia in new-born infants, and suggests a plan of distributing cards among all midwives, cautioning about this disease and directing immediate application for medical advice.
2. The overpressure of school work during growing years—which may seriously aggravate high myopia and cause possible detachment of the retina.
3. The possibility of sympathetic ophthalmia in neglected eye injuries, with resultant total loss of vision.
4. Finally, he stresses the improper quality of food, the tea and bread diet of the North of Ireland, as ruinous to women and children. A return to the porridge and soup diet would lead to a vast improvement in health.

He states that trachoma, a disease formerly prevalent in Belfast, has now

practically disappeared, thanks to the sanitary improvements so successfully carried out by the Corporation in removing the slums of Smithfield, etc.

It is interesting to note that in The Benn Hospital as early as 1879, the in-patients were divided into three classes :—

1. Poor patients admitted free of charge on recommendation of the sub-committee.
2. Suitable cases admitted on payment of ten shillings per week.
3. Private patients admitted on payment of fifteen shillings or thirty shillings per week, according to the ward selected; the acting surgeon being at liberty to charge his fees to such private patients.

A few years later, however, one finds in the acting surgeon's annual report a request that funds be provided to enable him to admit suitable cases without charge and without recommendation, so as to avoid unnecessary delay. Sound finance has always been the keynote of the Board of Management of this Hospital, and thus we find that in 1896 the money was forthcoming to build extensions which were found necessary. These included a special operating room with up-to-date lighting, six additional small wards, new bathrooms, a day-room for patients not confined to bed, and finally, a laundry.

Later in 1906, when Dr. W. M. Killen was senior surgeon, further renovations were carried out. It is interesting to note that at this time Mr. John Atkinson was acting as honorary secretary, a position he held for eighteen years. At his death his family donated a sum of £500 to the Hospital. In more recent times, further extensions have been added, to the approximate cost of £10,000. These were largely made possible by a gift of £5,000 in memory of Sir George and Lady Clark, and also through the generosity of Lady Dixon, who has been president of the Hospital since 1925. These various extensions brought the accommodation up to fifty beds. Unfortunately, this Hospital received damage during the enemy air-raids in 1941, but I am informed by Mr. F. D. McMullan, who has been honorary secretary for a period of more than twenty-five years, that while the extern department still functions as before, the intern department has been moved to Dunmurry, where thirty beds are available.

In 1909 the British Medical Association annual meeting was held in Belfast. In the section of ophthalmology, Dr. W. M. Killen demonstrated Dr. McKeown's technique in cataract operations, and the ophthalmic surgeons present were impressed by his method of washing out the débris following extraction of the lens. Colonel Elliott, a famous Anglo-Indian oculist, was enthusiastic about this new technique, and later published a paper giving results of eight hundred cataract operations in which this method was used.

Dr. I. Davidson was another well-known member of the Benn staff for many years. He was well versed in the French literature, having studied in Paris for some time. Of a quiet and retiring disposition, his recent death came as a shock

to his many friends. The present surgeon, W. A. Anderson, is one worthy to fill this important office.

Special Departments in the General Hospitals.

In 1882 the Royal Hospital decided to establish special departments for diseases of the eye and ear and also for gynæcology. This was done to meet the teaching requirements of the new Royal University.

An eye and ear extern department was established, and a small male and a small female ward were allocated for treating intern patients.

The total expenditure was not to exceed £20 per annum.

Dr. McKeown of the Benn Hospital was very sarcastic about what he termed this new £20 ophthalmic unit. He said the Royal Hospital staff were trying to make their students attend this unit, rather than come to a proper ophthalmic hospital which had ample material.

Dr. J. Walton Browne was asked to take charge of this new ophthalmic unit, but he refused the offer, as he did not wish to give up general surgery.

In January, 1883, Dr. Joseph Nelson was appointed the first ophthalmic surgeon to the Royal Hospital.

Nelson was a man of many parts. Having completed two years as a medical student, we find him as Sub-Lieutenant J. Nelson of the British Legion—a regiment of eight hundred English, Scotch, and Irish volunteers who, in 1860, fought with Garibaldi, the great Italian liberator.

As a young doctor he suffered from "wander-lust," and one finds him acting as a surgeon on tea plantations in India for fourteen years. Before commencing to practise in Belfast, he spent a considerable time working in Vienna under Professor Fuchs and Professor Von Arlt.

President of Ulster Medical Society in 1898-9, his boundless hospitality was shown in the unique idea of dining every member of the Society in small parties of six or eight. The parties have been referred to as "a feast of reason and a flow of soul."

Dr. Nelson was the only ophthalmic surgeon on the staff of the Royal Victoria Hospital when it moved to its present quarters, so it must have been he who was responsible for the lay-out of the ophthalmic unit. During the intervening forty years no enlargement has been made to the wards (which contain only sixteen beds and two cots), though a new operating theatre has been built.

About 1925 the out-patient department was moved from its original position in the general extern to allow the X-ray department to move to a position nearer to the general wards. The out-patient department was to be housed temporarily in the King Edward Memorial Building—a building certainly never designed for an out-patient department, whatever else it was designed for. The present quarters are hopelessly small, and it is well-nigh impossible to run an efficient out-patient department under these circumstances.

Dr. Nelson was followed by Mr. James A. Craig, who was later joined by Mr. H. Hanna; both these men are known to you personally: they had borne the heat and burden of the day for more than thirty years, and had just retired from the active staff of the Royal Victoria Hospital when the present war broke out. In the early days of the war, when the shortage of medical specialists became acute, they promptly volunteered to come back to their old haunts, and if it had not been for their valuable services, it would have been quite impossible for us to carry on.

The Mater Hospital established an eye and ear, nose and throat department when the present Hospital was opened in 1900. Dr. Killen was appointed first ophthalmic surgeon, but he resigned about 1904, and Dr. Shaw took over. Shaw was followed by Dr. Haydn Mulholland, while to-day Mr. D. V. McCaughan is in charge.

The City Hospital established an ophthalmic department about 1904, and appointed Mr. James A. Craig to take charge. I am told it was in the first instance mainly to deal with cases of trachoma. Since Mr. Hanna was appointed thirty-odd years ago, the department has enlarged tremendously, and to-day it includes a large block in the children's section.

The Academic Side.

In 1879 the Royal University of Ireland was formed, and it consisted of the three Queen's Colleges in Belfast, Cork, and Galway.

About 1886 one finds that candidates for the M.B., B.Ch. examination may be required to exhibit reasonable proficiency in the use of the ophthalmoscope and laryngoscope.

Sometime in the "nineties" a definite examination was held in ophthalmology and otology.

In 1896 a Lectureship in Ophthalmology and Otology was established at Queen's College, Belfast. The first lecturer was William McKeown (1896-1905), then Cecil Shaw (1905-1913), and next, James A. Craig (1913-1937).

In 1937 I was appointed lecturer in ophthalmology (note *not* "and Otology"), and as holder of this appointment have to recommend to the Medical Faculty a person qualified to lecture in oto-rhino-laryngology. This latter appointment is not a university lectureship. Mr. F. A. MacLaughlin has been delivering these lectures, prior to his going on active service at the outbreak of this war.

Let me finish this history by giving a few hard facts.

Figures can often be misleading, but the following will give you some idea of how the demands of to-day have got beyond the various hospitals' capacity.

In 1894 (fifty years ago).	In-Patients	Total No. of Cases
Ophthalmic Hospital - -	94 ...	1,756
Benn Hospital - -	151 ...	1,644

In 1919 (twenty-five years ago).

Ophthalmic Hospital	225	...	2,307
Benn Hospital	488	...	2,000

In 1942 (to-day).

Ophthalmic Hospital	710	...	5,412
Benn Hospital	695	...	5,087

Thus in the Ophthalmic and Benn Hospitals the number of persons attending has risen from 1,700-odd to 5,300-odd in fifty years. The admissions have increased from 100-odd to 700-odd in a similar period in each hospital.

To-day the total waiting-list of the Ophthalmic, Benn, and Royal Victoria Hospital (Ophthalmic Department) is over nine hundred, and it continues to get longer daily.

You will now appreciate that our hospitals have no history except that of doing a great work. At the same time, you are all well aware that satisfaction cannot be permanent for the Art of Medicine.

And so, in the words of a famous Prime Minister, let us turn to the future with a freshness of outlook, a directness of purpose, a certain impatience of conventional and circuitous methods.

Everything points to the Government of the country being forced to take a much more active interest in our Hospital Services in the future than it has in the past. Thus in October, 1941, the Minister of Health in the House of Commons made a statement indicating the Government's post-war policy, which included "to enquire into the organisation of Medical Services, particularly with regard to facilities for clinical teaching and research."

An Interdepartmental Committee has been set up, and the following are among the questions that will be considered :—

The proper organisation and distribution of medical schools; the appointment and remuneration of teaching staff; the provision of an adequate range and variety of cases for study, and for suitable laboratory equipment for teaching and research, including the possibility for linking hospitals for educational purposes; and the organisation of post-graduate teaching, both for students specialising in some branch of medicine and for practitioners desiring to attend refresher courses.

The hospital system in this country was originally intended to provide medical and surgical treatment for the sick poor, and was dependent on voluntary subscriptions and charitable bequests in order to carry on its work. During the last forty years it has undergone certain modifications, which have considerably altered the whole structure of hospital practice. The National Health Insurance Act in 1911 enabled a large number of persons to receive treatment from their panel practitioners, but did not provide for the treatment of major illnesses. It would now seem that the State is being forced to recognise this serious deficiency in its Health Services, and is at the present time reviewing the general situation.

From the hospital point of view, the tendency seems to be to divide the country into areas, each area having a teaching school as its main centre. At this centre units would be organised in the various specialities, which would include among others an orthopædic unit, a plastic unit, a unit for the treatment of cancer cases, as well as an ophthalmic unit and an oto-laryngology unit.

These units to have two main functions:—

1. The treatment of cases by a team of experts.
2. The education of the undergraduate and the post-graduate in an institution supplied with an adequate staff, adequate accommodation, and adequate material for teaching.

It is essential, however, that these special units be linked together, in order to facilitate co-operation with other departments of medicine.

At present in most of the larger cities the subjects of ophthalmology and oto-laryngology are treated as separate and distinct specialities, and undoubtedly this principle will be adopted here when a central unit is established.

In the subjects of ophthalmology and oto-laryngology there is provision for the teaching of undergraduates, but when it comes to post-graduates' teaching and research, we are sadly deficient.

In order to comply with the regulations for the Diploma in Ophthalmic Medicine and Surgery or for the Diploma in Laryngology and Otology, a graduate must have attended a special hospital which has an adequate teaching staff and ample clinical material. This latter is defined as a hospital with at least fifty beds. In such a hospital one would require not only resident medical officers, but also a number of junior qualified specialists, some of whom should be whole-time officers and paid according to their status. The senior staff would thus be enabled to devote more time to the more difficult and serious cases, and also to research.

The existing state of affairs goes to prove the old saying that medical staffs give of their best but are often badly organised. With the present dispersed organisation, we are unable to train our own young graduates, or have a sufficient concentration of material to carry out research work. In my opinion, this end could best be achieved in our city by the amalgamation of the two small special hospitals, with the special department in the Royal Victoria Hospital, by the building of a new unit in the vicinity of the Royal Victoria Hospital and the Institute of Pathology.

In order that the number attending the out-patient department might be kept under control, it might be feasible for some of the junior staff to carry on an out-patient clinic at various specified provincial hospitals. They might also be able to staff the school clinics throughout the province. As regards the in-patient department, I am strongly of the opinion that all major ophthalmic operations should be performed in the parent unit: here one would have not only an efficient theatre staff with all available modern instruments, but also a nursing staff well trained in the nursing and after-care of these cases. From the oto-laryngology point of view, there ought certainly to be a first-class endoscopic clinic, where all

cases requiring the passing of a bronscoscope or an œsophagascope could be treated. All adult cases of tonsillectomy should be dealt with in the central unit, but this would not be a feasible proposition where children are concerned, as the numbers are too great. The junior staff might deal with these cases in the provincial hospitals or other centres. By centralising all the major operating, the senior staff would be in a better position to cope with all this work, and patients throughout the province would have the satisfaction of knowing that the best medical and nursing staff was available.

From the nursing point of view, the advantage of linking up with a large training school is important. The time spent by probationer nurses in the special departments would form part of their general pre-registration training. In small hospitals at present the time spent by probationer nurses does not count in their general training.

From the financial point of view, there would be a certain reduction in the nursing personnel. A great deal of reduplication of expensive surgical equipment would be eliminated, and general overhead charges, such as food, heat, light, laundry, etc., would be reduced.

With concentration of cases, a better filing and record system could be devised; this would enable research work to be undertaken with greater ease. This is important from the medical point of view, as it enables us to compare and contrast our work with those working in similar centres elsewhere.

In any new institution, I am strongly in favour of an ample supply of beds for "private patients." These patients are just as much entitled to the advantages of modern equipment, etc., as their less fortunate brethren.

I do not know whether this scheme will become a practical proposition in my time, but we do realise that as regards our hospitals, our forefathers have endowed us with many advantages, and we should do our best to transmit these to future generations not only unimpaired, but with increased efficiency and value. Our endeavour should be to alter Shakespeare's seventh age of man, so that he is no longer "sans eyes, sans teeth, sans taste, sans everything."

REVIEW

FRACTURES AND JOINT INJURIES. By R. Watson - Jones, B.Sc., M.Ch.Orth., F.R.C.S. Volume II. Third Edition.

In this volume, which gives both pleasure and profit in the reading, every injury of the bones and joints of the limbs is described with the author's usual clarity, and profusely illustrated with X-rays and photographs.

The mechanics of each injury is thoroughly explained and its treatment clearly described in detail, so clearly that if the book has a fault it is perhaps that it makes treatment seem too simple, and gives the impression that any failure to obtain complete restoration of function must be attributed to the surgeon and not in any way to the injury.

The last chapter, "Highlights of Fracture Treatment," should, I think, be read first. It contains the text of the sermon. The whole book is intensely interesting and practical, and little or no time is wasted on theoretical discussion, and should be read by every medical man who treats injuries of the bones and joints.

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Premedication in Anæsthesia

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Premedication is one of the most valuable elements in the production of good anæsthesia and is of great psychological importance. Every anæsthetist knows how difficult it is at times to get good relaxation, without deepening the anæsthesia to a dangerous degree; with a suitable narcotic administered one hour before operation, these difficulties should be greatly lessened. There would seem to be several main indications for premedication :—

(1) To render the patient sleepy or sedative before coming into the theatre and to eliminate fear.

(2) To shorten the period of induction, and lessen the amount of general anæsthetic needed, without interfering with the depth of the anæsthesia.

(3) To diminish the amount of mucus secreted, and to try to avoid post-operative vomiting.

(4) To procure a longer period of insensibility to pain.

In the early days when morphia was first used, it was used to deepen the anæsthesia and to prolong the period of insensibility. Later, it was noticed that when morphia was given less anæsthetic was needed. Atropine was added to prevent cardiac inhibition, it also acts as a respiratory stimulant, and so counteracts the depressing effect of morphia, and it inhibits the excessive secretion of mucus caused by ether.

To-day more attention is being paid to the psychological effect of premedication, the very definite influence that the mind has over the body being more fully recognised. This is not altogether a new theory, but a very old one that is becoming better understood. It is probable that the amulets and talismen of the early centuries had a psychological value, for there is evidence that some of the sick got well, without any other aid. At a meeting of the Royal Society of Medicine, Dr. Bernard Hollander was able to show from his own experience and of others, that full surgical anæsthesia could be produced by hypnosis.[1] But this method is not likely to play a large part in the practical administration of anæsthetics, though Dr. Hollander was of the opinion that in certain circumstances hypnosis might replace the preliminary drugs used to procure calm and banish apprehension, and that it might be employed alone or as an aid to induction. One of the elements in the fear induced by the prospect of an anæsthetic, apart altogether from that due to the operation itself, is the fear of the unknown : this is an instinctive fear. Throughout the ages the race has had to be afraid of the unfamiliar and approach it with caution, and in the nervous individual this fear is very much accentuated. In their book, "Outwitting Our Nerves,"[2] Jackson and Salisbury quote from Crile (Origin and Nature of the Emotions) : "We fear not in our viscera alone, fear influences every organ and tissue. . . . Nature has one means of response to fear, and whatever

its cause the phenomena are always the same, always physical." That fear and anxiety do influence every system in our bodies is a common and daily observation of all who practise medicine.

Dr. Crichton-Miller draws attention to the fact that because a patient is a human being his physiological processes are enormously more influenced by emotional factors than is the case with the lower animals, and that this is a fact we must remember when using hypnotic drugs. That though the doses and action have been accurately worked out on animals, there is always the personal factor to deal with, even though physiologists may tell us that the nervous organisation of the higher vertebrates, including man, is based on the same pattern.[3]

The anæsthetist must take his part in the surgical team. The special needs of the patient and the special needs of the operation should be considered, and the best possible combination of drugs for premedication and for maintaining the anæsthesia used. The ideal to be aimed at: that the patient can have confidence, that the anæsthetic will be safe and pleasant, and the after-effects as few as possible. At the same time, the anæsthesia must be such that the surgeon is able to work with the greatest ease possible, the better the relaxation the less damage is done to the tissues, the time of the administration is shortened, and the amount administered is lessened.

The Basal Narcotics are the most recent drugs to be used in premedication, and it is claimed for them that they lessen or eliminate most of the difficulties encountered in anæsthesia. They help to lessen shock by reducing the sensitiveness of the nervous system to painful stimuli, and by eliminating the element of fear. It is also claimed that nausea and vomiting are less after the basal narcotics. Respiratory difficulties are seldom met with when the barbiturates are used; respiratory arrest is more likely to occur when no premedication has been given and the anæsthesia is too light. In abdominal surgery in particular good relaxation is essential, and it is not always easy or even possible to find the cause of resistance: repressed fear is more often the cause than is recognised.

Pre-anæsthetic medication decreases the general body metabolism and lowers the demand of the body tissues for oxygen. The desired level of anæsthesia is more quickly and easily reached with the minimum disturbance of the muscular, respiratory, and circulatory systems. The respiratory excursion is lessened, an advantage especially in upper abdominal surgery, the secretion of mucus is less, and there is a decreased tendency to nausea and post-operative vomiting. Adequate premedication helps to protect the patient from the depressing effect of prolonged or deep anæsthesia and to minimise surgical shock. According to Crile, the exclusion of both traumatic and emotional stimuli will prevent shock. It has been suggested that death during induction may be due to an excessive secretion of adrenalin being poured into the circulation and causing ventricular fibrillation, the excess of adrenalin being due to fear or apprehension. This is an accident most common during induction with chloroform, and can be prevented by giving atropine beforehand and avoiding a strong concentration of chloroform on the mask. I should mention that adrenalin should never be given during a chloroform administration, though it may

be given before the anæsthetic is started. "Reflex" shock can be prevented by good sedation, deep general anæsthesia, or by nerve-blocking. Prolonged fear or anxiety exhausts the sympathetic nervous system, and tends to produce shock and a lowered metabolism.

Mórphia with atropine, omnopon with atropine or scopolamine are probably the most common drugs in use. When scopolamine is given there is much better amnesia, and also atropine is not necessary. Atropine should always be given before the administration of chloroform.

Basal narcosis, a basis of light sleep, safe and pleasant, aims at the comfortable production of unconsciousness and narcosis deep enough to allow surgical anæsthesia to be maintained with a light anæsthetic such as nitrous oxide gas and oxygen. No basal anæsthetic should be used in sufficiently large doses to produce full surgical anæsthesia, the exception being the intravenous barbiturates such as pentothal.

The barbiturates are derivatives of barbituric acid; they produce a calm sleep, depress the respiration, but have no depressant action on the circulation; they cause an initial drop in blood-pressure, and they are excreted in the urine. They cause no appreciable change in the healthy liver or kidney; in hepatic and in renal inefficiency their elimination is delayed. The barbiturates enter into a chemical combination with the lecithin and cholesterin of the lipoid tissue in the brain. They interfere with the normal activity of the neurone, the will and the intelligence are abolished, but the patient is not completely isolated from his surroundings, he is capable of responding to external stimuli, but he does not remember. Barbiturates are said to protect against the toxic effects of local anæsthetics.

DRUGS USED IN PREMEDICATION.

Those that Produce Basal Anæsthesia :—

Bromethol—is administered per rectum in a 2½ per cent. solution of distilled water.

Dose : 0.1 cc. per kilogramme body-weight.

Paraldehyde—Dose : 1 drachm per stone body-weight up to 7 drachms. Given per rectum in :—

(1) 10 per cent. solution normal saline.

(2) Olive oil, proportion 1 drachm paraldehyde 1 oz. oil.

(3) 4 oz. starch solution.

Pentothal Sodium (*Lilly*)—Dose : ½ to 1 grm. (15 gr.) in 20 cc. of sterile distilled water, administered by intravenous injection.

Morphia gr. ⅙ or *omnopon* gr. ⅓ may be given one hour before any of these drugs.

THOSE THAT PRODUCE SEDATION :—

	Evening before Operation	One Hour before Operation
Nembutal (Abbott)—capsule : gr. 1½ -	1 capsule ...	2 capsules
Sod. Soneryl—capsule : grm. 0.15 - -	2 capsules ...	2-3 capsules
Seconal (Lilly)—capsule : gr. 1½ - -	2 capsules ...	2 capsules
Luminal - - - - - - -	1—3 gr. tablets	

Morphia ⅙ with hyoscine 1/100, or *omnopon* ⅓ with *scopolamine* 1/150, can be given one hour before operation, preceded by any of the above drugs on the evening before the operation.

Atropine 1/100, fifteen minutes before operation.

CHILDREN.

From twenty-four hours to six months—Pot. brom. gr. 1; chloral hydrate gr. 1; glucose ½ drm; tr. belladonna m. 2; given half-hour before operation.

Over six months—

Nembutal—		*Sod. soneryl*— (by weight)		*Seconal*— (by weight)
6 months—2 years -	gr. ¾	2 stone and under -	½ capsule (0.075 grm.)	½ gr. per 10 lbs. body-weight, up
2— 5 years -	gr. 1	2—3 stone -	½—1 capsule	to a total of
		3—4 stone -	1—1½ capsules	3 gr.
5—10 years -	gr. 1½			
10—16 years -	gr. 2	4—5 stone -	1½—2 capsules	
16 years and upwards -	gr. 3	5—6 stone -	2—2½ capsules	

Syr. of Chloral—

2 to 3 years—1 drm., increasing by ½ drm. up to 3½ drm. at 7 years.

Atropine—6 to 9 months, 1/200—1/100; 9 months and upwards, 1/100—1/80.

Over six years—

Bromethol or paraldehyde may be given, the dose being the same as for adults.

In deciding which of the drugs on this list we will use for our premedication, we must consider the patient, the surgeon, and the operation, and the anæsthetic we propose to give. The average healthy adult raises no problem, and two capsules of nembutal (gr. 3) an hour before operation renders the patient drowsy and comfortable and gives a considerable degree of amnesia. The adolescent is better without morphia preoperatively, though it may be used in small doses after operation. The elderly patient should have one of the slower acting sedatives the night before operation, such as luminal (gr. 1½-2), patients over 70 years are better with omnopon or morphia and atropine rather than scopolamine.

The patient with toxic goitre and the over-anxious patient should be well premedicated, if not already on a sedative, they should be given luminal or one of the other barbiturates for several nights previous to the operation, bromethal (basal dose) preceded by omnopon (gr. ⅓) an hour before, or a barbiturate such as nembutal (gr. 1½) with their morning tea, and omnopon (gr. ⅓) with scopolamine (gr. 1/150)

an hour before operation. The quickly-acting barbiturates should be used with caution or not at all in the toxic case, and the patient suffering from shock : morphia or omnopon is best for these cases. In pulmonary and in cardiac disease the drug should be chosen that will make the patient sedative and throw no extra burden on the respiratory or circulatory systems. In Cæsarean section the danger to the baby must be remembered and morphia avoided, very light premedication with scopolamine or seconal may be used.

Pentothal is a quick and pleasant method of rendering the patient unconscious, but bromethol is more kindly still, for the patient goes to sleep in bed and the post-operative period of sedation is much longer. Pentothal can be given to almost every type of case, it should be given in a 5 per cent. solution. Bromethol is not the anæsthetic of choice for the elderly, the very stout, or the patient with a poor myocardium, neither should it be used where there is impairment of liver or of kidney function. Not more than omnopon gr. $\frac{1}{3}$ or morphia gr. $\frac{1}{6}$ should be given in the immediate post-operative period, and not until the patient is awake and complaining. Paraldehyde is eliminated by the respiratory system, and therefore is better not given to chest cases.

For major operations the patient should be in hospital or nursing home at least thirty-six hours before the operation; they get well rested, their diet is supervised, and plenty of glucose is given. It is better to give too small a dose than to give too large a dose of any drug used for premedication; where an error has been made, coramine or methedrine may be given to counteract the narcotic effect of the particular drug used. It is well to remember that "No anæsthetic agent is safer than the person who administers it."

REFERENCES.

1. HOLLANDER, BERNARD : *Lancet,* 13th Feb., 1932, p. 357.
2. JACKSON and SALISBURY : *Outwitting Our Nerves,* third edition, p. 81.
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The Choice of Anæsthetic

By James Elliott, M.D., D.A.

In the early days of anæsthesia, almost a full century ago, the sole requirement of an anæsthetic was that it should render the patient oblivious of the surgical procedure, or at least free from pain. Nowadays, however, the anæsthetic is required not only to do this, but also to facilitate the surgery by securing muscular relaxation in many operations; to vary his technique so that bad-risk patients have their risk reduced to a minimum; and as far as possible to minimise the pre- and post-operative discomfort of the patient.

To attempt to fulfil these requirements, he has at his disposal a variety of agents and methods, which are continually being augmented. Briefly, the conditions are fulfilled by :

1. General anæsthesia.
2. Spinal anæsthesia.
3. Regional and local anæsthesia,

or by a combination of 1 with 2 or 3. The last method, that of regional and local anæsthesia, can free the patient from pain and in many cases provide complete muscular relaxation without reducing the safety margin, but, except in the case of local infiltration or distal nerve or field block, is time consuming, sometimes intricate and often uncomfortable and objectionable to the patient. Most patients prefer oblivion during operation. These last qualities have tended to make it only seldom used here, except in the presence of some contra-indication to general anæsthesia.

Nor is the second method—that of spinal anæsthesia—a popular procedure here, except for lower abdominal, lower limb, or perineal work. The margin of safety does not seem to be so wide as with the more commonly used general anæsthesia. If the patient's comfort is being considered, it will usually have to be combined with some form of light general anæsthesia. There seems to have been a disproportionate number of anæsthetic emergencies and even catastrophes with it.

The first method, that of general anæsthesia, is the one in routine use here. It is the one usually preferred by patients, and adequate muscular relaxation can usually be obtained. Disadvantages include the fact that post-operative vomiting and nausea are fairly common; that there is probably a slightly greater liability to post-operative chest complications; that muscular relaxation increases with the dosage of anæsthetic agent, and therefore relaxation is obtained at the cost of a somewhat diminished margin of safety, an increased liability to vomiting afterwards, and other toxic side effects of the anæsthetic agent. Usually, however, relaxation can be obtained without much ill effect on the patient.

The title of this paper, "The Choice of Anæsthetic," is taken to refer to general anæsthetic agents and techniques, and the other two methods will be mentioned only briefly.

With reference to good-risk patients, it has been said that the general anæsthetic agent or method used is of much less importance than the quality of its administration. When taken as applying to the actual risk to the patient, and aid to the surgeon, this statement would seem to be true. But it does not seem to be true when applied to the comfort of the patient. Also for, say, extraction of teeth, there is one agent generally conceded to be the most suitable—nitrous oxide. Chloroform or ether, where nitrous oxide was available, would be generally considered quite unsuitable. But as a generalization, referring to operations of moderate duration and requiring a fair degree of muscular relaxation, it is, broadly speaking, true for good-risk subjects, that the quality of administration is of more importance than the agent used. This is not true, however, when applied to bad risks. In these, the relative importance of the agent has increased considerably and the anæthetist has a definite choice to make, based on the patient's pathology, the nature of the operation contemplated, and his knowledge of the qualities and characteristics of the agents and methods available to him.

There is some risk attached to all operations under anæsthesia. Part of that risk is due to the anæsthetic agent, which derives its element of risk from two fundamental factors.

1. A toxic influence on vital tissues.
2. The production of anoxia.

There are other factors, such as idiosyncrasies on the part of the patient, but these are central ones. The perfect example of an agent with a toxic effect on vital tissues is chloroform, and of an agent liable to produce anoxia is nitrous oxide. But no clear-cut line can be drawn between the two, as anoxia accentuates toxicity, and is accompanied by it. An any rate, the risk to the patient increases side by side with an increasing poisoning of the tissues and (or) with an increasing anoxia. These states of increased poisoning and increased anoxia are brought about in two ways :

1. By an excessive dose of anæsthetic agent or an inadequate supply of oxygen, and
2. By a normal dose of anæsthetic agent or a normal amount of oxygen supplied to a patient whose tissues, already poisoned, are incapable of coping with a normal dose of anæsthetic, or, already suffering from oxygen lack, are in need of excess oxygen.

It is in the patient whose tissues are already poisoned or suffering from oxygen lack, by reason of disease or trauma, that the choice of anæsthetic agent becomes important.

This choice will depend largely on the stage of poisoning which the tissues have already reached, by reason either of toxæmia or anoxia, and on the operative procedure to be carried out. For example, nitrous oxide-oxygen would not seem to be the anæsthetic of choice for a patient suffering from a decompensated heart, as the heart is already having considerable difficulty supplying adequate oxygen

to the tissues. Nor would chloroform be indicated in a patient suffering from, say, a diseased liver.

The one agent we have which is stated to be non-toxic is nitrous oxide. This claim has recently been challenged, but at any rate, it is probably our least toxic agent. Unfortunately, only very light anæsthesia is attainable with it except in the absence of adequate oxygen. The oxygen scarcity *may* be tolerated in the patient whose vital organs are not already poisoned or lacking in oxygen, but will *not* be tolerated if they are already diseased or poisoned. So the use of nitrous oxide-oxygen is limited, in those cases for which otherwise it would seem ideal, by reason of its non-toxicity. Of the two dangers, that of a toxic drug in the presence of adequate oxygen is considered to be less than that of a practically non-toxic drug in the absence of adequate oxygen. Toxic drugs have their ill effects reduced to a minimum by supplying adequate or excess oxygen. So far, only some general principles, which, at any rate in theory, should be considered when choosing the anæsthetic to be used in a poor-risk patient, have been discussed.

I want, in two further rough sections, to consider first, the agents available, and their chief properties and characteristics; and second, some poor-risk types of cases, and the agents which I think are indicated.

The following is a list of the agents in common use, arranged roughly in ascending order of toxicity :—

Nitrous oxide, ether, cyclopropane, trilene, chloroform. It does not include the agents used for short 'whiffs,' such as ethyl chloride and vinesthene. To this list we may add penothal sodium, now sometimes used for quite long and major operations.

Nitrous oxide has already been mentioned. In addition to the points already noted, it has the following characteristics. It is not irritating to the lungs and has no taste or smell. Induction and emergence from anæsthesia are very rapid. Except where there has been severe anoxæmia, there is seldom any post-anæsthetic vomiting.

Ether, on the other hand, is extremely irritating to the respiratory passages. It is highly inflammable in concentrations of 2/36 per cent. in air and 2/82 per cent. in oxygen. It is only slightly toxic and has a very wide margin of safety. It is still the most widely used agent, although the first one used in practice ninety-eight years ago. Sickness following its use is fairly common. This tendency seems to be accentuated by prolonged deep anæsthesia and by an inadequate oxygen supply due to any cause, such as an obstructed airway. Its use for induction of anæsthesia is difficult and unpleasant for the patient. Unless very carefully used, the tendency with ether anæsthesia in the early stages is to a resistant type of breathing, and in a robust patient, except with heavy premedication, a boisterous induction is difficult to avoid. This is often associated with breath-holding and anoxæmia, which in turn produce a raised blood-pressure and other side effects. These points may be of importance in some types of bad-risk patients.

Cyclopropane has been in use as an anæsthetic agent for fifteen years. A potent

drug, it is given with amounts of oxygen varying above and below 90 per cent., according to the depth of anæsthesia required. It is non-irritant to the lungs. Induction is just less rapid than with nitrous oxide, and emergence is also rapid. It is only slightly toxic except in deep anæsthesia, when cardiac irregularities may be produced. These can usually be eliminated by the addition of oxygen. The blood-pressure is raised, at any rate in the early stages. Bleeding under anæsthesia is exaggerated. There is only a slight rise in blood sugar. Relaxation can be obtained, but sometimes with difficulty, as breathing may become very shallow or stop before it is achieved. Post-operative vomiting is less than with ether. It is highly inflammable and explosive. Usually the most notable feature of cyclopropane anæsthesia is the quiet smoothness of its course from the start until the required depth is reached. The excitement stage is often absent and seldom marked. The patient maintains a well-oxygenated appearance throughout except where the airway becomes obstructed.

Trilene, or trichlorethylene, to which a preservative and some colouring matter have been added, also a recent addition, has still not got much beyond the experimental stage. It is non-inflammable, but forms phosgene in the presence of an open flame or spark. It is only very slightly irritant to the respiratory passages; is not easily vaporized; and is difficult or impossible to use on an open mask. Relaxation is very difficult to obtain. Quick, shallow respirations tend to occur. Cardiac irregularities are common if completely adequate or excess oxygen is not supplied. Trigeminal nerve palsy has recently been described following its use, and in the current issue of the *British Medical Journal,* thirteen cases of cranial nerve palsy, two of them fatal, have been attributed to the use of trilene with soda lime in closed circuit.

Chloroform is also non-inflammable. It is extremely toxic to body tissues and has a specially marked effect on the heart. Only slightly irritant, it produces deep anæsthesia fairly quickly. There is a very small safety margin. Relaxation is very marked and post-operative sickness very common. Bleeding at the site of operation is slight, because of a fall in blood-pressure. Excess oxygen minimises the anæsthetic risks. Apart from risk due to overdosage, chloroform renders the heart more liable to primary cardiac failure, which is usually attributed to ventricular fibrillation, and occurs in light anæsthesia following some premature stimulation of the patient, or due to the administration of adrenaline. Delayed chloroform poisoning may also occur, especially when the liver is already diseased. The typical chloroform anæsthetic is smooth, with quiet respirations, a pulse gradually becoming soft, a poor peripheral circulation, and good muscular relaxation.

The remaining drug to be mentioned—pentothal sodium—is the successor in the barbiturate series to evipan as a general anæsthettic administered intravenously. It is usually given in 5 per cent. solution, this strength being thought to tend less to venous thrombosis; to cause less irritation if injected around the vein; and to be less depressant to respiration. Owing to a greater depressant effect on the sympathetic than on the parasympathetic nervous system, pentothal has the effect of making the larynx very sensitive. Spasm occurs on slight irritation, such as

the addition of ether after pentothal, or an attempt at intubation of the trachea. Spasmodic coughing and spasm of the limb muscles sometimes occur. The drug is broken down by the liver and excreted by the kidneys. It was thought to be contra-indicated where sulphonamides were in use, on account of the sulphur atom in its molecule. Anæsthesia is almost instantaneous. For short operations the drug is injected quickly, in small or moderate dosage. This causes a concentration in the brain above the anæsthetic level without corresponding amounts in the body tissues, and allows of quick reduction below the anæsthetic level in the brain by diffusion to other body tissues. For longer operations it is injected slowly, with the idea of raising the concentrations in the brain and body tissues side by side. In this case there is only a slight descending gradient of concentration from brain to body tissues, and reduction below the anæsthetc level occurs slowly. The drug is contra-indicated in the presence of inflammation in the region of the glottis; in hepatic disease, and to a less extent in renal disease; and in conditions where there is gross cardiac or respiratory deficiency, including asthma. Where there is some irritative lung lesion, such as bronchitis, even in the absence of gross deficiency, there is a liability to spasmodic coughing, which is difficult or impossible to overcome. Venous thrombosis, prolonged drowsiness, excitement, nausea, vomiting, and headache, have all occurred after its use, but are rare.

It remains now to suggest a choice of agent for some of the more commonly met types of bad risk, and in doing this, one seems to turn with regularity to cyclopropane.

For example, in cases of cardiac decompensation, the main requirement, as already mentioned, is adequate oxygenation with as little expenditure of energy by the patient as possible. Cyclopropane is our best answer. The question of some form of local or regional anæsthesia will probably arise, and its suitability will largely depend on the surgery to be carried out. Ether and oxygen is also quite a satisfactory anæsthetic for patients with bad hearts, but it falls short of cyclopropane in the induction stage, which with the former tends to be much less smooth than with the latter.

Patients suffering from an acute respiratory infection without much loss of function chiefly require an agent which will not further irritate the lungs. Nitrous oxide-oxygen may be adequate for some minor operations, but if anything of greater magnitude is intended, cyclopropane again seems to be indicated. It is also probably the agent of choice where there is gross loss of function of the lungs, such as in pulmonary tuberculosis, pneumothorax, etc. In the cases without gross loss of function, such as acute bronchitis, spinal or regional anæsthesia is often used and pentothal may also be of use, though it is in this type of case that intractable coughing sometimes occurs with it.

Asthmatics may be given almost any inhalation anæsthetic and ether is not contra-indicated, but pentothal should not be used.

Cyclopropane is very useful for patients with hepatic or renal disease. Ether may be used, and a combination of the two is sometimes helpful, especially in upper abdominal surgery where relaxation is essential.

Cystoscopic examinations can be done under pentothal anæsthesia, either alone or augmented by nitrous oxide-oxygen.

Operations requiring relaxation of the anal sphincter, such as removal of hæmorrhoids, are made easier by combining a low spinal anæsthetic, such as 1.2 cubic centimetres of hyperbaric percaine, given with the patient sitting up, with some form of light general anæsthesia, such as that given by the pentothal nitrous oxide-oxygen sequence.

The anæsthetic given to a patient suffering from severe shock will depend on whether relaxation is required. If not, nitrous oxide-oxygen will probably be adequate, as in these patients a high percentage of oxygen can usually be given, and is always essential. If deeper anæsthesia is required, cyclopropane is probably the choice. Ether and oxygen is also quite good, but is usually less smooth, and lasts longer.

In patients of normal risk, as mentioned at the beginning, choice of anæsthetic is of much less importance, and the chloroform-ether, ether sequence is still the most commonly used method in hospitals. It still bears quite favourable comparison with closed methods of anæsthesia following nitrous oxide-oxygen induction, in short operations, such as simple appendicectomy. In the longer, more shock-producing operations, however, the benefits of closed circuit anæsthesia with CO_2 absorption become evident. Even in the shorter operations a nitrous oxide-oxygen induction is a much less unpleasant procedure for the patient than a chloroform-ether one, and post-anæsthetic sickness is less.

Cyclopropane is very useful in midwifery—the most noticeable difference from, say, chloroform, being its effect on the uterus, which is usually firmly contracted. Post-partum hæmorrhage is therefore very unlikely. It seems odd that light chloroform anæsthesia in midwifery is thought to be relatively safe, yet it is light chloroform anæsthesia in which the danger of primary cardiac failure is greatest.

In infants, ether and oxygen is very satisfactory. Nitrous oxide-oxygen can be used, but is difficult to control and is only of use for light anæsthesia.

In dental anæsthesia, nitrous oxide-oxygen is best, as it is quickest and leaves least hangover. If the patient is of the anæsthetic resistant type, the nitrous oxide may be supplemented, either by a preliminary small dose of pentothal or by the addition to the nitrous oxide of some ethyl chloride or vinesthene.

Trilene has not received much mention. It seems most suitable for operations requiring only fairly light anæsthesia, such as amputation of breast, when it can be added, say, to nitrous oxide-oxygen without causing any breath-holding or objection on the part of the patient. According to this week's *B.M.J.* report, it should never be used with CO_2 absorption in a closed system.

Finally, minor surgery, such as the opening of infected fingers, reduction of dislocations, etc., is very often facilitated by the use of pentothal, which will produce a quiet anæsthesia in place of the straining, tense anæsthesia of nitrous oxide-oxygen only.

The list of agents available also includes acetylene, ethylene, and some others,

but cyclopropane and the ultra-quick acting barbiturates seem to be the most valuable finds of recent years.

The ideal general anæsthetic agent would give a quick, not unpleasant induction, complete muscular relaxation with light anæsthesia, and quick emergence without nausea or vomiting.

As such a drug has not, and is not likely to be discovered, there would appear to be a place for the use of some of the more easily performed field blocks, which would assist relaxation without deep anæsthesia, and thus maintain a wide margin of safety, with diminished tendency to post-anæsthetic nausea and vomiting.

The anæsthetic chosen for a particular case by different anæsthetists will sometimes differ, but the broad principles governing the choice will be the same.

REVIEWS

SURGERY OF MODERN WARFARE. Edited by Hamilton Bailey, F.R.C.S. Published by E. & S. Livingstone, Edinburgh.

THAT a surgical book requires a third edition within three years of its first publication, shows that it fulfils a need, and is a fitting testimonial to the high standard of the work.

This third edition of "Surgery of Modern Warfare" is published in six parts instead of the two volumes of the second edition. Only the first three parts are now completed—the other three are to follow shortly.

Like the previous edition, the illustrations are profuse and, indeed, in some chapters the illustrations are so good that it is almost unnecessary to read the text. Treatment of war wounds, civil injuries and lesions, following on the stress of war, are all brought up to date and clearly and concisely explained. The principles of treatment enunciated are sound. These volumes will be a great standby for the house surgeon as well as for medical officers in the Services, and we feel sure the volumes will be retained by these medical officers for reference when they return to civil practice.

ILLUSTRATIONS OF REGIONAL ANATOMY. By E. B. Jamieson, M.D. Published by E. & S. Livingstone, Edinburgh.

A KNOWLEDGE of anatomy is essentially one of vivid picture memories, and Dr. Jamieson has drawn his pictures of regions of the body in such a clear way that they are rapidly and clearly impressed on the memory.

The work is divided into seven sections, with a volume to each section or region. Each region shows the anatomy of the bones and of each layer of soft structures superimposed. The colourings are vivid and the relations of important structures well shown. This book will prove very useful to the student on return from the dissecting room, or to the student revising for an anatomical examination.

A practising surgeon, on looking over the book, would have no hesitancy in deciding that the drawings were those of a pure anatomist. He would like to see similar drawings, showing those pictures of anatomy he meets with in the stages of surgical operations, but probably this is covetousness on the part of the surgeon, and he must content himself with congratulating the anatomists on this addition to their library.

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The anæsthetic chosen for a particular case by different anæsthetists will sometimes differ, but the broad principles governing the choice will be the same.

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The Prognosis of Syphilis

By H. B. Jones, Major, R.A.M.C.
Command Dermatologist, British Forces, Northern Ireland

My subject, The Prognosis of Syphilis, is chosen in due consideration of the fact that this topic is one of medicine's most intricate problems. Moreover, unless one has a clear conception of the exact position, one is quite unable to answer the questions which the patient is sure to ask on recovery from the shock on establishment of the diagnosis of syphilis. By authoritative replies to such questions much can be done to rectify the attitude of confusion and degradation which exists. What is more important and essential than to help patients to readjust themselves to such misfortunes? Preaching and moralising are taboo. Medical men are interested in *health,* not morals. So long as there is no anxiety for medical advice, it is not sought, and when fears arise they may not be expressed, though often severely realised. But it is well that the physician should appreciate that *fear* is present and that it is no less real because it is not *confessed.* What the patient is really saying is : "What does this symptom or loss of efficiency mean to me in my future?" "Can you, doctor, make me well?"[1]

The prognosis cannot be given unless the progress of the disease present is known, and also the stage at which it has been reached, and the value of curative treatment available clearly understood.[2]

Therefore, on establishment of the diagnosis, the initial concern of the patient is bound to be :—

A. Potential Infectiousness to Others.

B. Possibility of Cure.

C. Likelihood of Ultimate Disaster.

These questions cannot be answered nor can the patient be successfully treated unless the physician has a clear conception in his or her mind as to what is meant by :—

1. Infectiousness.
2. "Cure."
3. Probable Developments in the Case of :
   (a) No treatment,
   (b) inadequate treatment,
   (c) good treatment.

It is as well to consider what is meant by *infectiousness.* Infection usually occurs by *direct* or *indirect* close contact of moist surfaces, such as occur from the genitalia or mouth of a recently infected individual.

Earle Moore has shown in examination of the clinical signs of many thousands of cases that 95 per cent. are conveyed by sexual intercourse. In the remaining 5 per cent. of extragenital infections, approximately 4.5 per cent. result from some

practice which is primarily sexual. About half of the extragenital chancres occur in and about the mouth and anus through kissing or by some mode of sexual play or perversion.[3]

It is yet unproven whether the causative organism can penetrate the unbroken surface of the mucous membranes in human beings, or whether a break in the continuity is *essential* for infection.[4]

From the moment of entry of the causative organism of syphilis—the treponeme pallida—there is a rapid multiplication of organisms at the inoculated site; where, after an incubation period of from ten to ninety days (usually twenty-one days), a "sore" appears, and shortly afterwards the appearance of painless rubbery enlargement of the lymphatic glands of the groin. The organisms, too, enter the blood stream from the site of the inoculation, and in turn leave it for the more favourable environment of the tissues. All tissues are probably invaded, but lesions develop in those that are more favourable for growth and residence than others : i.e., mucous membrane of the mouth, eye, and nervous system in particular.

After six weeks all this culminates in a secondary outbreak with its great diversity of lesions. All these lesions teem with the causative parasite of syphilis, but there is little or no destruction of tissues. These secondary manifestations, if untreated and the course of infection uninfluenced from without, do heal *spontaneously*. These secondary lesions, depending on their intensity and type, persist for days, weeks, or months without any residual permanent scars. Active become exquisitely an inactive chronic infection : latent syphilis then develops without symptoms or signs. This is ACUTE SYMPTOMATIC SYPHILIS.

One is accustomed to think that the establishment of syphilis is always heralded by the development of the chancre, but it is quite evident that this does not always occur.

A considerable number of persons acquire syphilis without ever exhibiting signs or experiencing symptoms of the acute stage of the disease. How often is the neurologist in interrogation of patients with tabes pariesis confronted with no history of initial lesion. It may be so trivial as to pass unnoticed. Unfortunately, to date the exact mechanism which operates in this ASYMPTOMATIC ACUTE SYPHILIS is entirely unknown.

For some time it has been the clinical impression of many of us that patients presenting themselves with Late Syphilis could give no history of syphilis (30 per cent. of men and 60 per cent. of women). This may be due to :—

(i) The average patient is often thought to be an inevitable liar and unreliable witness. This is certainly unwarrantable, and more often than not is due to the manners and methods of the interrogator.

(ii) The initial lesion may be wholly insignificant—a mere abrasion, hidden *cervical* or *intra-meatal* chancre, the transient roseolar rash, tiny painless mucosal lesion. These may have escaped the patient's notice.

(iii) The presence of coincidental infections, gonorrhœa and syphilis.

From examination of many thousands of case cards of army patients presenting

themselves for a final test of cure of gonorrhœa, this has been found only in 1.5 per cent. It is naturally very important to recognise this type of acute syphilis, as these cases are a danger both to the individual and community. They form large unrecognised reservoirs of syphilis capable of spreading infection as potent carriers of disease. In this way infection too is spread very surreptitously by direct sexual contact in the thus fully ignorant and by women to their offspring.

Keller and Nevasquez, in a series of examinations of cases of the cardio-vascular and neuro-syphilitic manifestations of late syphilis, found 50 per cent. of the cases gave no history of prior acute lesions.

ACUTE ASYMPTOMATIC SYPHILIS depends upon :—

(a) The amount of infection : experimentally there is evidence that the initial lesion does depend upon this. Whether or not it can apply to humans is another matter.

(b) Syphilis appears to be more violent in adolescents and the elderly than in young adults and middle-aged persons.[5]

Certainly congenital syphilis is commonly fatal in young infants.[6] So, too, the incidence of asymptomatic congenital syphilis is much lower than acquired syphilis. It has been my clinical impression that the very young and elderly lose the power to suppress the *acute* manifestations. Moore has pointed out that the chief difference between early congenital manifestations and those of acquired syphilis are quantitative rather than qualitative.[7]

The visible clinical signs are of a secondary designated type, with the addition that the infant exhibits signs of visceral involvement and severe toxæmia. The very young and very old appear to lose the capacity to suppress acute manifestations of syphilis.

(c) Asymptomatic acute syphilis is twice as common in women as in men.

Certainly not one-half of the women developing late syphilis give a history suggestive of the acute disease. Is it not, too, the common experience of many clinicians that twice as many men as women attend any out-patients' department or clinic with acute syphilis.

This, of course, may be attributable to pure differences in the anatomy of the sexes. Therefore, as these types of case are fraught with such difficulties, no case who presents himself or herself with a history of recent exposure should be dismissed summarily without a detailed clinical examination, and a three-months period of surveillance with appropriate serological blood tests, as is the practice in His Majesty's Forces here in Northern Ireland and elsewhere.

Our next problem is what lesions in syphilis are infectious.

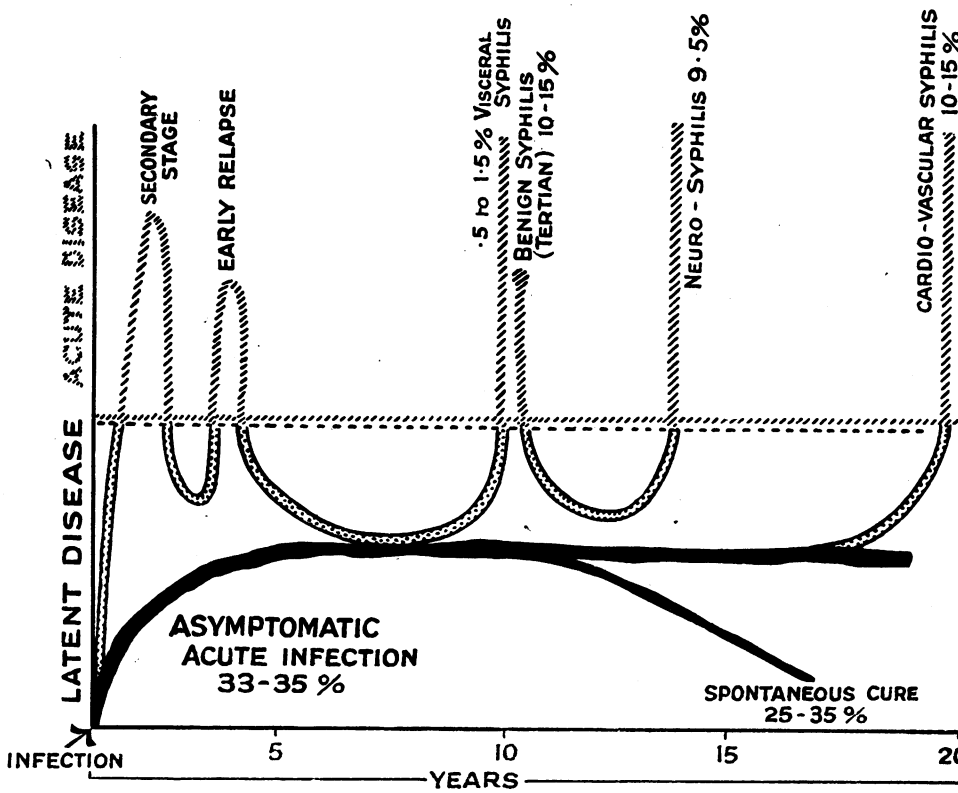
A. The risk of accidental infection is *rare,* irrespective of the prevalent lay belief to the contrary. In a series of 4,500 cases collected and examined by me at West London Post-Graduate School, Hammersmith, in the ten years preceding this war, I found the risk from household contact very small, i.e., 0.02 per cent. (only nine cases). Therefore the patient should be warned against the possibility of infecting

others, but it is safe to assure him and his associates that the true danger lies in sexual contact.

B. *All lesions* of the mucosal surfaces in early syphilis, either acquired or congenital, are infectious.

Any lesion on the moist surface of the genitalia, in one who admits sexual contact in any form, should be regarded as a *potential infection* until, by repeated dark-ground examinations, they are proved otherwise. Much suffering and many mistakes can readily be averted by these means.

It is quite an apparent and established fact that *moisture* is a prerequisite for the transmission of syphilis.



PROBABLE OUTCOME OF ACUTE UNTREATED SYPHILIS.

C. The mucosal lesions of early or relapsing secondary syphilis are highly infectious and all lesions teem with treponeme pallida.

Don't be misled that patients who exhibit pure cutaneous lesions and no visible mucosal lesions are *not* potential dangers.

In all such lesions infectivity persists until complete healing occurs by (i) spontaneous "cure," or (ii) under treatment.

These cutaneous lesions decrease in numbers and severity as potential infectors with the passage of time.

Coupled with the problem of what clinical manifestations are infectious is, when is syphilis actually infectious?

From the vast material of the Clinical Co-operative Group in the United States, it can be correctly assumed that exposure to an *infected* person does not always result in *infection*. So, too, must be the experience of many syphologists. It seems to depend upon various factors in personal hygiene.

Experience in the Services has produced much data in this respect, i.e., the use of early treatment packets in prophylaxis.

The investigations of Chesney et alii show, by the use of the contraceptive jellies, that there are alterations in the ph. value of the vaginal secretion. The danger of transmission from direct sexual contact is greater in the first year, and still great in the second year, but it rapidly lessens as time goes on. From statistics based on clinical examinations, it is apparent that an infected person acquires his or her infection from an infector who has contracted early syphilis within two years of exposure. After the fifth year the risk of infection from a consort or partner infected with syphilis is one in 25, and after the tenth year, one in 120 or more. This, of course, does not apply to the risk of infection of the child in utero by its mother, and even here the mere passage of time does not apparently obviate the risk entirely. Moreover, a patient can or may transmit infection through an intact mucosa. An infected female, herself non-infectious owing to: (1) duration of the disease, or (2) some other reason, may act as a passive carrier of the disease. How often has one not met such cases where the vagina of an infected, though non-infectious consort, contains treponemata deposited in her by one partner, and thereby infects the next in sequence.

Some observers dispute this owing to the absence experimentally of these parasites in vaginal or cervical secretions.[9] Is infectivity dependent upon relapse? It has been clearly shown there is little or no light upon this. Any answers on this subject seems to me mere speculation, whether viewed from experimental or clinical data. Relapse seems to occur, irrespective of either the nature or kind of treatment. It is less frequent in the first year and then progressively more frequent in the second and third year. The recent work of J. E. Kemp in the clinic of Johns Hopkins Hospital, Baltimore, has shown that semen may be infectious when the male has an obvious mucosal lesion of syphilis, and that the treponeme pallida enter the semen in its passage over these lesions. It is rarely, if ever, so in the case of those with an infection of more than four years duration, treated or untreated. Milk may account for occasional infections in some few infants, so that it is a matter of safety to refrain from allowing infected mothers to nurse their infants.

The Effect of Arsenical Therapy.

The next point of consideration is the effect of single and multiple doses of trivalent arsenicals and heavy metals as used in modern methods. In the light of modern treatment, the trivalent arsenicals in combination with bismuth do control

infectiousness rapidly and almost completely. Bismuth alone controls it very slowly, and it is days or even weeks before surface organisms disappear.

Mercury, except in very special circumstances, has little or no effect on the parasite of syphilis. By dark-field examination it has been observed that, with adequate dosage of a single injection of arsenic, the treponeme pallida does disappear from the superficial lesions in three to six hours.

The patient is therefore non-infectious except by intimate contact.

But the rapidity of the disappearance depends upon the size of the dose and is directly proportionate to it. By observance and examination of several hundred case cards, it is found that infectiousness, as judged by the disappearance of the lesions and organism, are inter-dependent upon the number of the actual doses given. It has been repeatedly shown by observers that patients treated with less than twenty injections of trivalent arsenicals develop infectious relapse :

(a) Those with one to four injections only show 65 per cent.

(b) With only five to nine injections 13 per cent.

(c) With more than thirty injections 2.7 per cent.

This, to my mind, points to a combination of inadequacy of the chemico-therapy and failure to allow establishment of immunity. The patient is not given a chance for the natural forces of resistance to develop.

For some considerable time much controversy has raged as to what is the best method of administration of treatment. Reference will be made later to the modes employed at present, but unfortunately, there is neither time nor space to discuss the merits or demerits of individual methods. It will be readily agreed that *early* syphilis is most highly infectious in its first days of occurrence and when the blood result is negative. Therefore, there is no relation between actual potentiality of infectiousness and blood reaction results. In patients with muco-cutaneous relapses, there is by no means so universal a serological positivity as is found in an established outbreak of secondary syphilis.

Nowadays these results depend upon the sensitivity of the particular test employed, if not upon the actual serologist who undertakes them.

In *late* syphilis, irrespective of its type, and in those of more than four years duration, 95 per cent. of all blood reactions are *positive,* but such patients are far from *infectious*. This latter fact has led many hygienists and legislators into tragic errors and hasty conclusions both as to individuals and masses of people. The clinician, in full consideration to these points, should then discuss fully and frankly with those patients in whom an established diagnosis of syphilis has been made. It is advisable to deliver explicit instructions to all patients suffering from syphilis in all its phases. These instructions should be divided into those with less than five years infection and those with more. In the former no sexual intercourse should be allowed for six months. It may be permitted with a protective sheath, provided that the patient is still undergoing treatment. Attention should be also directed to the minor details of household contact, i.e., use by other persons of the articles which the patient is using. In those with a late syphilitic infection—it all depends

upon whether the partner is infected or not. If he or she is infected, then the use of mechanical protection is obligatory. Household contact is not to be feared.

The Cure.

The second question in the consideration of the subject of this paper is the "cure." This should be viewed from both the physician's and the patient's viewpoint. Current literature in the lay press has done much of late to belittle the effects of treatment and further raise a hazard in the confused minds of the patients. The effect of treatment has been definitely *understated* both here and in the States. This is wrong and harmful.

The cure from a syphilogist's point of view should be :—

(1) To become and remain symptomatically well for life.
(2) To be incapable of transmitting infection to others.
(3) To become and remain serologically negative in both the blood and spinal fluid.

From our point of view it is as well to examine the meaning of these. In (1) and (2) the acme of 'cure' from our point of view is, that the patient becomes and remains well, as far as luetic infection is concerned, for the remainder of his or her life, and is incapable of transmitting the disease to others. It is possible to obtain this 'status-quo' without eliminating the last remaining parasite. Often patients may be symptomatically and signically free from all traces of disease and non-infectious, yet still retain a positive serology in the blood or fluid or both. Whereas in (3), this means that both blood and spinal fluid become and remain persistently negative from the commencement of treatment until the end of life. Many patients do retain foci of syphilitic infection in their bodies, clearly evidenced by subsequent relapse, yet achieve serological 'cure.' Much depends, too, upon the sensitivity of the serological test and its modifications. This latter is and has been of great concern to all serologists. Colonel L. W. Harrison and Brigadier T. E. Osmond have done much to clear up the doubts which exist in the minds of us all who are concerned with syphilotherapy.[11]

The cure from the patient's angle and his question will surely be: "What are my chances, doctor, of becoming and remaining well, with no further recurrence of the disease?" What he requires is an assurance which is made with reference to other diseases, e.g., tuberculosis. Estimate and explain clearly in terms of symptomatic 'cure.' This is all that is necessary, not laborious scientific dogma and data.

Avoid religiously all scientific data and laboratory findings and tests. It is unwise, unnecessary, and unwarranted to labour him with such facts. It tends to confuse his mind. Discuss frankly with him the following :—

Firstly, that there are no laboratory tests or criteria which can be applied at a given moment, which will settle the issue of 'cure.'

Secondly, if at any time he is re-infected or does relapse, he must submit himself to adequate and energetic further treatment.

Thirdly, each and every patient must resign himself to periodic medical inspection for the rest of his life at one-, two-, or five-yearly intervals. To some patients this comes as an additional and almost unbearable shock—unless tactfully approached and the necessity of such clearly explained. Segregation of facts and figures presents a better picture than it would seem. There are, of course, varying requirements for various types of the disease. It is my personal ritual that after completion of adequate treatment, the patient is submitted to full clinical, X-rays, and serological examinations undertaken by independent observers. If, then, findings are satisfactory, he is instructed to report each and every three months for the first year, and afterwards at one-, two-, and five-yearly intervals to some reputable syphilotherapist. In order that he may find his yearly date of necessary overhaul easy to remember, I request him to make this attendance the day before or after his successive birthdays.

In the light of common sense, the complexity of prognosis may be viewed from the angle of the actuary, pathologist, and serologist. These are, of course, only of academic interest to our colleagues and ourselves. From a *clinical* viewpoint a great deal of inaccuracy, which makes syphilis the cause of death, is probably due to the unwillingness of the patient's doctor to disclose the cause of death as syphilis, lest it may produce publicity and wound the feelings of sorrowing relatives or jeopardise insurance claims.

As ferreted out by no less authority than Sir William Osler, many of the inaccuracies which have occurred in the statistics available are due to this.[13]

Many observers believe that irrespective of more effective control and adequate treatment, it still ranks in the group of the four great 'killer' diseases :—cancer, tuberculosis, and pneumonia.[14]

Many statisticians have stated definitely that syphilis creates in the human body a *triple hazard,* in that :—

(a) an unfavourable outcome may occur;

(b) there is the possibility of a fatal reaction to treatment; or perhaps

(c) lowered resistance to other diseases.

From analysis of many thousands of cases, both in the army and civil practice, I am little impressed that (a) is a potential danger factory. Whereas in (b) it must depend largely on the stage of infection. I assume, I am safe in saying clinical opinion, if not impression, may lead one to believe that syphilis does add considerably to the risk of direct or indirect resistance to other diseases. A classical example is the tremendous incidence of infective hepatitis in those undergoing arsenical therapy.

I have refrained from any discussion of the prognosis from the pathologist's attitude, as I feel there are others better able to do so than I am. But I feel strongly that in the absence of other clinical stigmata, it is entirely wrong to view syphilis from the serological standpoint. Often has it been found that persistent clinical and pathological activity does occur, with progression, in the face of

negativity in all serological tests. Many patients, too, go through life with permanently persistent positive serological tests without other evidence of infection. In some, or maybe in many, no amount of treatment does or will alter this.

What Does This Mean?

Does there exist foci of infection and active lesions somewhere in the body? Or does the blood-test remain positive after all lesions are healed and last treponeme pallida vanished? An expression parallel to the expression of immunity after the eradication of the infection in typhoid, when a positive Widal reaction persists.

To date, the question has been unanswered. Chesney and his co-workers have done much to add to the possibility of the latter.[15] Many patients can and do go through life with no other clinical evidence of syphilis than a positive blood test.

This may provide the patient with a healthy optimism as to ultimate prognosis, but it is not intended as a suggestion that the disease should be allowed to pass untreated.

If you rely on the findings of serological blood tests, then adequately treated early is nearly always curable, but late syphilis rarely so.

Finally, to consider the probable results in event of :—

A.—Untreated Cases.

Acute syphilis, once it obtains entry into the human body, is a *progressive* disease, but it is rarely lethal per se, but occasionally disabling. In the acute stage, the patient is a menace to his or her fellow-creatures by transmission of his infection; 25 per cent. will eventually die or become incapacitated by the disease; and about 12 per cent. will develop benign active syphilis. The remainder will experience no personal menace. This should not be allowed to influence the patient nor herald undue optimism in his or her mind.

B.—Inadequate Treatment.

The effect of this varies accordingly with the duration of the disease. In early syphilis a little treatment may be worse than none at all. This can be explained by :

(a) The patient's resistance may be in the making against the disease, and until secondary syphilis has healed and latency firmly established it is not complete.

(b) Treatment may interrupt this, and may do for the patient what, if left alone, he would do otherwise for himself, i.e., heal and destroy lesions.

(c) If treatment is stopped, the patient is left without any defence against foci which exist, and they may multiply further in situ or be distributed far and wide.

Infectious cutaneous and mucosal relapse are much commoner in early syphilis inadequately treated than in the untreated.

It has been shown by such observers as Hall, Frankl, Hopkins, Kemp, et alii,

that inadequate treatment does materially shorten the incubation period of neurosyphilis.[16]

In late inadequately treated syphilis there is progression of the late lesion rather than relapse.

C.—What Has One to Offer the Patient by Adequate Treatment?

It is safe to say that early syphilis is curable from all points of view. The earlier it is commenced the better. From case cards selected at random I assume that :— 100 per cent. 'cure' is available in sero-negative early syphilis with early, regular, and adequate treatment. This may be reduced by scientific figures from 60 per cent. to 85 per cent. The difference lies between symptomatic and serological cure. In sero-positive early syphilis and early secondary syphilis it is only 85 per cent.

By "cure" being meant symptomatic arrest, freedom from recurrences, absence of infectivity, complete and permanent serological negativity.

In 95 per cent. of cases of late syphilis "cure" is attainable, if it is assessed in all three criteria of "cure," i.e., symptomatic, signs, and serological results, then the standard only reaches 65 per cent. Scientific data does not really interest the patient. As pointed out by Morgan, acute syphilis in men or women is highly infectious and is greatly dangerous to their intimate personal contacts.

They keep the epidemic of syphilis raging. Furthermore, the patient is in an extremely critical stage with regard to his future. It is in this acute stage, too, that there is the best chance of "absolute cure." The future situation is indeed critical. It is obvious, too, that the best treatment of late syphilis is the prevention of its development by adequately curing early syphilis. This is an important factor from all points of view. It should, therefore, place syphilis in the spotlight of the minds of all.

Below is illustrated the prognosis of acute syphilis studied by Moore.[17]

An Estimate of the Probable Outcome in Early Syphilis Untreated, Poorly Treated, and Well Treated.

Types of Syphilis		Probable Outcome Expressed in Approx. Per Cent.		
Original Diagnosis	Ultimate Outcome	Untreated	Inadequately Treated	Adequately Treated
Early Syphilis	Serious late Syphilis -	25	35–40	4
	Benign late Syphilis -	15	15	2
	Latent Syphilis -	30	15–20	5
	Cure - -	30	15–20	85–95

For some considerable time, much controversy has raged amongst syphilotherapists as to what is the best method of administration of the treatment.

At present the practice in vogue is :—

(a) INTERMITTENT METHOD.—This is the method used to a large extent in Great Britain. It consists of weekly injections of arsenic and a heavy metal, usually bismuth, given concurrently, and followed by a period of rest of four to six weeks; or

(b) CONTINUOUS TREATMENT, in which arsenic and bismuth are administered by :

(1) Alternative block method, by which arsenic and bismuth are given concurrently for eight or ten weeks for a period of twelve to eighteen months.

(2) Overlapping block method, in which arsenic and bismuth are given concurrently for two or three weeks at the end and beginning of each successive course.

(3) Concurrent method—Massive intensive therapy, in which the whole necessary dosage is administered in a period of days or weeks.

At present it is claimed by certain therapeutists, both here, in the States, and Canada, that this is the method of choice, as it reduces the incidence of *infectious relapse* to vanishing point.[18]

After all, infectious relapses lesions are inevitable in 1 per cent. of all patients, irrespective of (a) how much treatment is given, or (b) of what nature, as has been clearly shown by Paul Padget.[19]

What is considered to be adequate treatment, irrespective of the method used? It appears it must necessarily embody the following principles :

Firstly, the minimum duration must vary immensely with the degree of the disease present.

Secondly, the maximum amount of the drug must be concentrated by the minimum time.

Thirdly, it must attain a definite level of therapeutic efficiency.

Moore states : "It is unfortunate that no method exists by which the probable cures after small amounts of treatment can be picked out either before or after treatment. This hiatus in our knowledge is responsible for the undoubted fact that some patients receive and accept much more treatment than is absolutely necessary for them."[20]

Lloyd Jones and Maitland[21] have enunciated that by employment of the daily quantative serum test, these cases can be separated out in the early stages of acuteness of the disease.

To date it is impossible, except perhaps by the means of the D.Q.S.T. or Kolmer-Wasserman test, to discern how much is adequate treatment.

It is still my impression that therefore, in order to treat all patients adequately, some must be treated to a degree beyond the limits of bare necessity. By examination of many hundreds of cases, it is apparent that :—

(1) Sero-negative early syphilis should receive nine to twelve months regular treatment.

(2) Sero-positive early syphilis should receive treatment for at least fifteen to eighteen months.

(3) Early secondary syphilis should receive treatment for at least fifteen to eighteen months.

(4) Late secondary syphilis should receive trreatment for at least eighteen to twenty-four months.

In consideration of the "cure" and advisability of sufficiency of treatment, periods must be calculated from the date at which the serological results become and remain negative.

No treatment should be commenced without a full and careful examination of each and every individual patient. In this there should be a full investigation of the cardio-vascular, pulmonary, central nervous, urinary, ophthalmic systems, together with examination of the weight and the mouth. This investigation is of much greater importance in late syphilis cases. All drugs used in modern syphilotherapy are poisons, and there is always a likelihood of disaster.

From examination of much material, the relative risks of fatality from treatment are one in two thousand.

Full examination undertaken on the above-mentioned lines may avoid in patients with late syphilitic lesions :—

(1) Death as a result of a single injection, due to coincidental heart disease; or

(2) The conversion into a chronic invalid one in whom there is the presence of nephritis.

It is possible also to set up a "base line" to prevent the possible progression of infection in after years.

Is not progression always to be feared in late syphilis?

I am convinced it is a hazardous procedure to form and estimate the prognosis of late syphilis. It is assumed that the best outlook one can attain in this stage of syphilis is symptomatic arrest and the prolongation of the expectancy of life. No more, but perhaps less. If full examination of the patient's physical examination has been undertaken properly, realisation of the presence or absence of lesions of the cardio-vascular or central nervous system is accurately ascertainable. If these are present (and they are frequent associates of late syphilis) they call for the greatest caution on the part of the therapeutist. In some cases they may be below the threshold level of clinical detection, and these form the most fascinating "will-o'-the-wisps" of syphilotherapy. All untreated patients enter a period of undeterminate length after subsidence of all symptoms and signs of acute early syphilis.

This period is usually of seven years duration. In it there are no outward signs, and the presence of syphilis is often only recognisable by the presence of serological positivity.

There are three sets of phenomena now taking place, either :

(a) Slowly progressive inflammation, exquisitely chronic with subsequent fibrosis.

either

(b) Violent explosive destructive lesions, i.e., gummata (usually provoked by injury); or

(c) Spontaneous cure.

It is said 33 to 35 per cent. of all untreated acute syphilis terminate in this end.[22]

It is recognised that late syphilis is divided into the following :—

(a) Latent, which may be either within or after four years of the date of infection.
(b) Benign late, in which group fall the gummatous lesions of the osseous, visceral, and other systems.
(c) Cardio-vascular lesions.
(d) Central nervous lesions.

It has always been my confirmed policy *not* to embark on the treatment of any case of established late syphilis without a proven examination in full by a competent physician and radiologist, with full serological examination of the blood and cerebro-spinal fluid.

All treatment should then be carefully planned upon the results of these findings. It should be commenced by a careful "build-up" by iodides and heavy metals before even small doses of trivalent arsenicals are embarked upon. Earle Moore has tersely summarised the prognosis of LATENT SYPHILIS thus :—[23]

"If the infection has been present four years and there are no untoward effects by physical examination in either the cardio-vascular or nervous system, two in ten (even its worst, three in ten) develop serious trouble." If lesions do occur, there is not an even chance that they will be incapacitating, with cardio-vascular involvements (the chief risk to be feared). The danger of the development of neuro-syphilis (excepting only a more or less purely vascular *involvement*) is largely past by the time latency is established. The best outlook is therefore symptomatic cure, and few, adequately treated patients, will show clinical progression. (It appears that in late latency serologic negativity is not easily attained.) From examination of statistics, it is quite apparent that early latent syphilis is curable in 70 to 80 per cent. in the clinical sense. Of these, less than 5 per cent. of the properly treated patients acquire active lesions of chronic syphilis.

Even in the late latent state, irrespective of the Wasserman reaction reversal (rarely obtainable), less than 5 per cent. properly treated will later have symptoms or signs of the infection. It is quite apparent that treatment, even in this condition, reduces the mortality to less than 5 per cent.

In BENIGN LATE LESIONS there is always a tendency to relapse, especially gumma of the skin, mucosa, bones, and joints. Lesions of eye, nose, and palate call for the greatest ingenuity on the part of the therapeutist. The best chance of symptomatic arrest in cardio-vascular syphilis is the detection of uncomplicated aortitis. If one is fortunate to do this, adequate and carefully planned treatment can produce :—

1. Permanent arrest of progress.
2. Ultimate long life.
3. Symptomatic 'cure.'

With valvular incompetency or aneurysm, the average duration of life in the untreated is twelve to twenty-four months.

With correct treatment life may be prolonged in relative comfort for years.

In central nervous system lesions, all depends upon the involvement type present.

It is now possible to state with absolute definiteness that a patient with early syphilis, whose spinal fluid at the end of one year's probationery period following treatment (in absence of any subsequent relapse), or one of late syphilis (of more than four years duration) whose fluid was normal before, during and after treatment, will never develop paresis.

The Prognosis of Congenital Syphilis.

This depends to some extent on whether the infection is recognised and treatment commenced in early or late.

Untreated congenital syphilis has a high mortality rate, which cannot be abolished, but materially reduced by treatment.

Before commencing treatment in early congenital syphilis, it is well to remember that small infants suffer from—

(a) severe toxæmia, and

(b) concomitant lesions of the viscera.

The constitutional disturbance is therefore far more profound than in early acquired syphilis. Every opportunity should be afforded mobilisation of the body defences.

With full knowledge of this the treatment should be planned upon—

(a) Actual preservation of life.

(b) Radical 'cure' in all respects.

It appears that the concensus of opinion is that these small children can be given arsenic, provided that it is administered in graduated minute doses.

The drugs of choice are sulpharsenol, mercury, or bismuth.

From a series of statistics examined, the concensus of opinion is that these infants require at least one year's combined therapy. Whereas in late congenital syphilis it must be remembered the acme of the cure can only be symptomatic arrest and maintained good health. All treatment is based on these lines. Lesions of cardio-vascular and central nervous systems are rare complications. Twelve months appear to be sufficient, and the prognosis is better when latency is firmly established. The drugs which prove most effective are those trivalent arsenicals used in the treatment of acquired adult syphilis. Bearing in mind the frequency of asymptomatic acute syphilis in the female sex, the prevention of syphilis in pregnancy depends upon early routine treatment, with the repeated use of Wasserman reaction in each and every subsequent pregnancy. Once the diagnosis is established, energetic adequately planned treatment must always be undertaken. From examination of statistics published by Co-operative Clinical Group Cole H.N. et alii,[24] adequate treatment started before the fifth month is followed by a living non-syphilitic child in 91 per cent. of all cases.

This indicates, as pointed out by Ingraham,[25] that congenital syphilis is a preventable disease.

In conclusion, it appears that the chief concern should be to determine for the

patient his outlook and the probability of the development of the serious manifestations in the infections called 'syphilis.' From the mass of facts and figures, this infection is 'curable' in all senses in the early stages, but late syphilis only in the symptomatic sense. If one realises the frequency of asymptomatic acute syphilis, especially in the fairer sex, one may avoid the more serious lesions of late syphilis. Beware of all the possibilities of coincidental infections, especially in those with a history of recent exposure. No lesions, however trivial, should be disregarded, unless proved by oft-repeated meticulous clinical and microscopic examinations to be negative. The patient's best chance, when once the diagnosis in accurately established is regular, well controlled, and adequate treatment based upon the results of full clinical examinations and the individuality of each patient. It is only thus can the huge reservoir and medium of infection be reduced.

Yet in those wise words of Kipling :

"Whatever here I may declaim,
The very clever folk I sing to
Will most indubitably cling to
Their pet delusions all the same."

Unfortunately, I regret I am unable to quote many intimate figures from records compiled in His Majesty's Forces. These must be withheld for reasons of security.

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Bullet Wounds

By MAURICE LAVERY, M.SC., F.R.C.S.(ENG.), F.R.C.S.(ED.)

THE simple and common type of bullet wound shows an entrance and exit wound; but it is well known that a bullet often re-enters the body and a second pair of wounds results. Suppose, however, that the first exit wound and the second entrance wound are so close together that they form only one wound. The patient would then have three wounds and no lodged bullet. The second exit wound may, of course, be absent, leaving two wounds and a bullet lodged in a distant part of the body. I have known a case of this type where the bullet entered the deltoid region and left the body in the concavity of the neck above the clavicle, and re-entering immediately, lodged on the opposite side of the neck. The bullet in this case was discovered after twenty years, and an examination of the scars showed how the original error had been made.

Where a patient has a single wound, the bullet is often found under the skin. It would appear that the strong and elastic skin can hold up a bullet that has passed through and shattered a bone a few inches away.

The diagram (fig. 1) shows ten possible varieties of entrance and exit wounds where the bullet passed once or twice through the body. This diagram may appear somewhat complicated; but it is quite inadequate when we consider wounds of the intestine. The lumen of the bowel might be regarded as the exterior of the body, and an entrance wound on the anterior abdominal wall may be associated with an opening in the bowel lumen, and this wound could be described as an exit wound. If a wound is discovered in the bowel, a search will be made for a second wound, but it is obviously of great importance that a bullet may cause a single wound in the bowel. I do not refer to wounds of the bowel in this strictly correct sense, I regard the wound of the bowel as seen at operation from the peritoneal aspect, and while I admit that such a wound is an exit wound of the body, I prefer to call it an entrance wound of the bowel. The possible types of bowel injury caused by a bullet are described in fig. 2. In these five types of injury the peritoneum and muscle retract and the wound is larger in these layers than in the mucos membrane. A single coil of jejunum may show eight to twelve wounds. It must obviously be an even number, unless one of the injuries is the type A or B, shown in fig. 2, in which event there will be an odd number. The type C class of injury may be easily mistaken for a single wound unless a probe is passed into the lumen and the mucos membrane bridge demonstrated. When operating for small bullet or shrapnel wounds of the abdomen, I follow the track of the bullet through the abdomen and deal with the injuries in order from anterior to posterior as the missile passed through in a straight line. This has the advantage that there is no confusion and time is saved. I am aware that this departs somewhat from the advice that the arrest of bleeding and the closure of colonic wounds take first place, and I admit that these complications are urgent; but I think they should be approached in an orderly manner along the track of the bullet. I will describe four cases of this

type of injury with operative details. These are the only cases I have seen in the past ten years.

Case 1.—P. M. 10th May, 1935. Age 30. This man was shot in the abdomen by a .22 copper or bronze bullet, which passed through the left hand and entered the left side of the abdomen above the costal margin. The bullet had lodged below

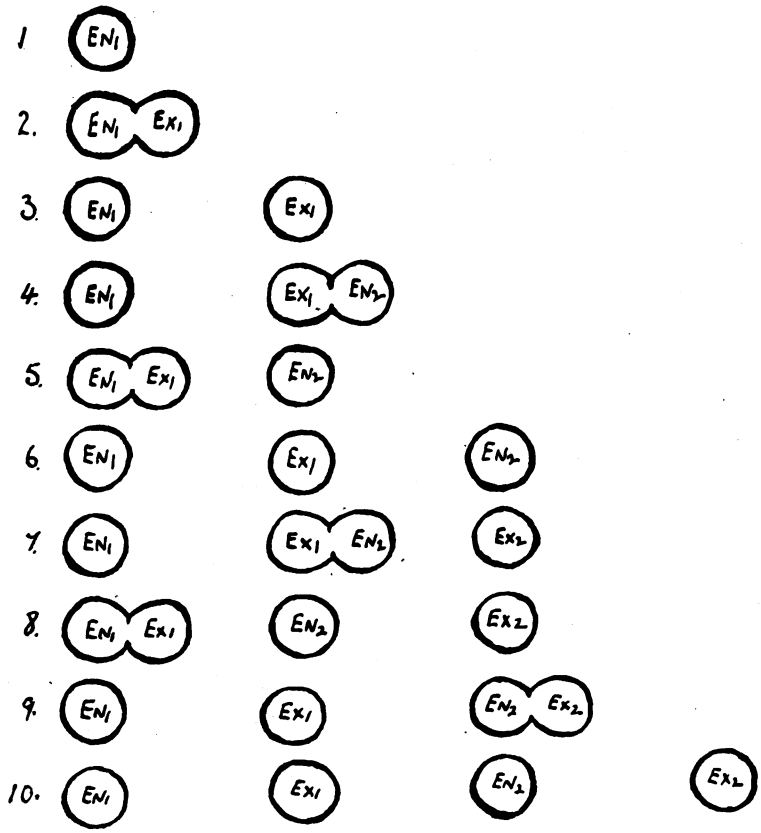

FIG. 1
Diagram showing types of entrance and exit wounds.
In 1, 3, 4, 5, and 6 there is a lodged bullet.
EN1 and EN2 are entrance wounds.
EX1 and EX2 are exit wounds.

the skin in the left renal area, about two inches above the iliac crest. The abdomen was opened four hours after the accident through a left paramedian incision, and a hole in the great omentum was demonstrated. It was now obvious that the stomach had escaped, and that the bullet had passed directly from the anterior abdominal wall to the omentum. This hole was repaired by a stitch, which picked up a small bleeding point. It was also obvious that the bullet had passed into the lesser sac, and when the omentum was turned up, a hole was found on the deep aspect, and quite close to this there were a pair of holes in the transverse colon.

The anatomical disposition of these holes was such that it was apparent that no structure in the lesser sac had been injured, and that the bullet had entered the left ilio-lumbar region of the peritoneal cavity, and that there were only two holes in the transverse colon, and finally, that the bullet was travelling slightly to the left. The colon was repaired and the jejunum was examined from above downwards, and six holes were found in one of the upper coils. These were repaired,

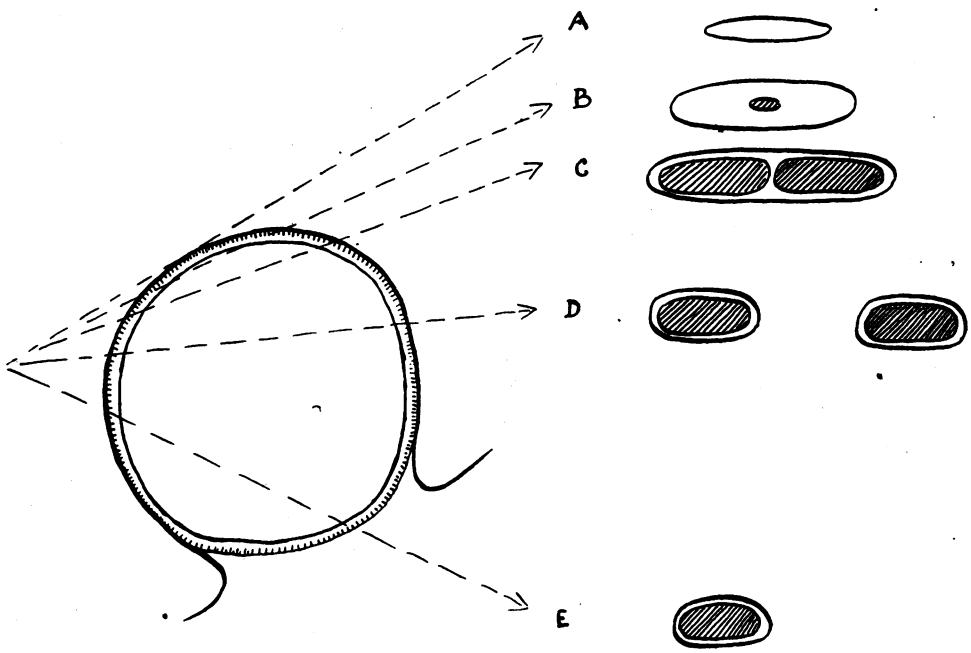

FIG. 2

Five types of bowel injury are illustrated by the arrows showing the track of the bullet in relation to the bowel. On the left is shown the types of wounds seen on examining the bowel at operation.

A.—Shows mucous membrane intact with the outer coats shaved.
B.—Shows a single wound of the mucous membrane.
C.—Shows a pair of wounds separated by a small bridge of mucous membrane.
D.—Shows a distinct pair of wounds.
E.—Shows a single wound, the second wound being extraperitoneal.

NOTE.—The wounds A, B, C, or D may occur in extraperitoneal areas.

and it was considered advisable to examine the entire small intestine, no other injury being discovered. It was now certain that there was an injury of the posterior wall of the left ilio-lumbar region, and that the left kidney, and more particularly the descending colon, must be examined for injury. In order to carry out this investigation, it was necessary to extend the original incision transversly to the left. This disclosed a tear of the peritoneum below the lower pole of the left kidney and to the medial side of the descending colon. This was repaired with a few catgut sutures. The abdomen was closed, the patient turned on his face, and the bullet excised through a small incision.

Case 2.—Private R. McC. 3rd September, 1939. Age 19. This soldier has some claim to fame, as he was shot at 3.30 p.m., war having started at 11 a.m. on the same day. The bullet was lead and slightly smaller than a .45. It entered the abdomen above and to the right of the umbilicus. The exit wound was in the right renal area, about half way between the last rib and the iliac crest. The abdomen was opened by a right paramedian incision, and a wound was found in the peritoneum above the transverse colon and at the outer edge of the duodenum. The peritoneum is thick at this point, and I do not think it would be correct to describe it as a part of the great omentum; but it was very close to the right edge of this omentum. This wound was enlarged, and two wounds were demonstrated in the extra-peritoneal part of the transverse colon. These were repaired, and the duodenum was now mobilised and brought forward, and a single small wound was found. The bullet now passed through the kidney, and this was left undisturbed. This man drained urine from the exit wound for two weeks and had some hæmaturia.

Case 3.—T. B. 20th September, 1940. Age 20. This man was shot from behind, and the exit and entrance wounds were almost identically the reverse of Case 2. The bullet was lead, .45 size. A small piece of omentum was protruding through the exit wound. When the abdomen was opened, an omental wound was found just below the right half of the transverse colon. When the omentum was turned up, a single entrance wound was found in the transverse colon. Small intestine was injured, as the bullet took a short course through the right iliolumbar region of the peritoneal cavity. The exit wound in the colon was extraperitoneal, and it was demonstrated by mobilising the bowel from above, and at the same time a single wound was found in the duodenum. The psoas muscle was extensively torn, but the kidney escaped injury. On passing a probe into the wound in the psoas muscle the operating table was touched. A sterile towel should be placed underneath these patients, so that the aseptic technique will not be interfered with.

Case 4.—Naval Rating S. April, 1941. Age 20. This man was struck in the abdomen by a small piece of a large bomb. There was a small entrance wound slightly to the right midway between the umbilicus and the symphysis pubis. A portable X-ray showed a shadow of an opaque body about one inch below the right iliac crest. The omentum was injured near the right lower border. The lower ilium had four wounds which were repaired. The ascending colon showed an entrance wound just above the iliocæcal valve. The cæcum and ascending colon were mobilised and turned medially to find the colon exit wound. This was small and valvular and difficult to find in the loose tissue of this region. After a somewhat prolonged search I noticed a few air bubbles in this tissue at one point, and closer examination revealed the extra-peritoneal opening.

I am glad to say that these four consecutive cases recovered. Operation was carried out within six hours of the injury. Morphia was given in large doses before operation for pain. No resection of bowel was necessary and no severe

bleeding was encountered. No blood transfusions or chemotherapy was used. Antitetanic serum was given. Drains were inserted down to colonic wounds.

An attempt was made in each case to visualise the track of the bullet and to examine carefully every important structure in relation to the track, and to deal with the injuries in order from anterior to posterior. Before operation, an attempt was made to forecast the structures injured by an examination of the exit and entrance wounds, and where the exit wound was absent, an X-ray examination was made. This is a very useful and instructive anatomical exercise; it is surprising how correct such a forecast may be, and the mistakes are instructive. At operation an attempt was made to distinguish the exit and entrance wounds of the bowel in order that the important and hidden extra-peritoneal wounds would not be missed. I understand that in the last war, when Paris was being shelled every twenty minutes by a long-distance concealed gun, that a shell passed through a building, leaving an entrance and exit gap in two parallel walls. Engineers were able to reconstruct the track of the shell from these two defects, and the exact compass bearing of the gun was discovered. Inside the abdomen a pair of wounds in the bowel help the surgeon by guiding him in the line of the track towards other injured structures.

I publish the details of exit and entrance wounds of the bowel because I find almost no information on this subject in text-books. I have not seen a description of a pair of wounds in the bowel separated by a mucos membrane bridge, and I think the two cases I describe with a single wound in the duodenum are of interest.

I have also described a plan of campaign for this type of injury, which is briefly following the track of the bullet. The first step is to find the hole in the omentum, and when this is turned up the peritoneal space which is affected is demonstrated. The contents of this space are investigated, and the track followed out of the peritoneal space to the exit wound.

I have to thank my friend, Mr. P. P. Wright, for permission to publish the details of Case 3.

The Pathology of Sepsis in the Newborn

By J. Edgar Morison,
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Infections are determined primarily by the environment in which the infant lives though their incidence and severity are modified by the constitution and nutrition of the child. Titmuss (1943) has argued that it is in this group of diseases that the social class distinctions in infantile mortality rates are most marked. It is in this group also that the major improvement in infantile mortality has occurred and must continue to occur. There has arisen an impression that infective conditions now only assume major importance after the first month and that, while they are then responsible for a high infantile mortality rate, they are in some measure capable of being brought under control. They do present a serious challenge then, but detailed post-mortem examinations also emphasise the importance of infections during the first month of life and of certain channels of infection too often overlooked. Far too many deaths in this period are incorrectly certified as due to prematurity or congenital debility.

The physician should understand something of the peculiar difficulties of the pathologist in this field. The newborn infant is making numerous and complex changes of both function and structure in nearly every organ of the body and the nature, significance and extent of these must be appreciated. A fulminant infection may produce no structural lesions. An inconspicuous one may kill by interfering with the proper development of some newly-acquired function of extra-uterine life, such as the absorption of food from the gut. A terminal infection in a body poorly integrated and functionally ill-adjusted to the environment may masquerade as the primary cause of death. Sometimes no amount of care and detailed study will produce sufficient evidence, and the sequence of events can only be reconstructed in terms of probability. All the changes in the function of the body may occur so quickly, and be associated with so little structural change, that morbid anatomy alone may be useless. A more energetic study of the infant during life would be extremely valuable, but at this age functional pathology, including bacteriology and biochemistry, is difficult and too little practised. Increased efforts are necessary for at present relatively little is known even of the normal physiology and biochemistry of the new-born.

The privilege of a necropsy is not an occasion for a brief survey of those organs most easily removed. Even in the most obvious case a complete post-mortem, including brain, middle ears, umbilical vessels, neck organs, tongue and sometimes spinal cord and long bones is necessary. Inadequate observation at this stage can never be corrected. At least one microscopic section must be taken from a suitable part of every organ whether it appears normal or not. The necropsy is only complete when these thirty, forty or more tissues have been suitably prepared and examined. These microscopic preparations are made by suitably trained laboratory technicians, but only a medically trained pathologist can relate the

changes of structure shown in them to the naked-eye appearances and to clinical observations made during life. The practitioner should not be discouraged from making necropsies, but without full facilities this branch of morbid anatomy is likely to prove disappointing.

The work of the pathologist is of little value unless it can be applied by those in practice, and it is hoped that a discussion of observations made in the mortuary and in the laboratory may help to eliminate conditions responsible for a very considerable proportion of the neonatal mortality.

Umbilical Sepsis.

When the umbilical cord is tied that part between the ligature and the abdominal wall undergoes gangrene. Where this joins the body a line of separation forms, fibrous tissue proliferates actively and invades the blood-clot lying in the vessels, and a limited infiltration by polymorphs assists in the separation of the dead tissue of the cord. If the granulation tissue is not infected, epithelium closes in rapidly and completely after separation of the cord. Until the blood-clot in the umbilical vein is well organised by fibrous tissue, there is nothing to prevent the spread of organisms from the gangrenous stump through the blood-clot to the patent umbilical vein lying in the abdominal wall. The blood-clot at the umbilical end of this extends only three to six mm. along the living vein wall and into it fibroblasts and capillaries grow actively from the third or fourth day. Prematurity or other debilitating conditions will be unfavourable to the closure of the vein by granulation tissue. It is doubtful if an effective barrier is formed until after the cord has separated.

It is difficult to assess the significance or frequency of infection of the blood-clot in the umbilical vein. Minute infected thrombi, or bacteria themselves, might find their way from it to the liver or by the ductus venosus to the lungs. With the death of the patient, a week or so later, it might be almost impossible to decide whether a low-grade infection had preceded the organisation of the thrombus in the lumen of the vein or not. If the infection has extended from the gangrenous stalk to the blood stream in the early days of life, the infection at the site of the cord insertion may then appear to be the least important lesion. A more severe infection developing later at the umbilicus might be adequately walled off by granulation tissue and might not invade the blood stream. It is admitted in the literature that in many of the most serious infections the umbilicus appeared clinically healed (Friedlander, 1927; Chamberlain, 1936). This is not sufficiently appreciated, and many still think there is no cause for concern unless there is a sinus exuding pus, a spreading cellulitis, or a palpable umbilical vein thrombosed to the liver.

In work not yet published the author has maintained that in the absence of primary liver damage an infiltration of the portal tracts of the liver by adult polymorphs is evidence of a serious blood stream dissemination. These cases were often complicated by sepsis elsewhere, especially in the lungs, and this could often be interpreted as secondary. The umbilicus, and especially the umbilical vein, was

examined microscopically in great detail in these cases, but it was impossible to formulate even microscopic criteria which would prove the passage of bacteria. This invasion was thought to have occurred during the first few days of life. It is perhaps significant that all showed an abnormally marked fall in the birth-weight with no recovery after the fourth day. Diarrhœa of varying severity was regarded as secondary to the parenteral infection. In a further group of cases there was an unhealed and infected umbilicus and, though there were no liver lesions, this may have served as the primary focus for the septic lesions found elsewhere in the body.

It is probably almost impossible to keep the gangrenous umbilical stump bacteriologically sterile, but it is important to exclude pathogenic bacteria. A moist gangrene is most undesirable and a dry dressing is best, but both the dressing and the powder must be sterile. A little antiseptic will not keep either the powder or the wound sterile, and nothing will take the place of strict surgical asepsis. Bathing, especially in a bath, before the navel is healed is a most precarious and biologically unnecessary operation. For this reason, and because of the danger of minute skin abrasions, the vernix is not removed in many modern maternity hospitals.

Thrush Infections.

One of the commonest infections of the newborn is by the fungus called *Monilia,* or *Oidium albicans,* and in hospitals where the attack-rate has been carefully studied an incidence of 20 per cent. is not uncommon (Ludlam and Henderson, 1942). The "white mouth" produced by this parasite is familiar as thrush stomatitis, but that infection can spread down into the œsophagus and lead to death is not always appreciated. Ten such cases have been seen in the last year, and in six of these it was the major cause of death. It is especially liable to attack premature or debilitated babies, but healthy babies, even if breast-fed, are not immune. The mouth has been noted as heavily coated as early as the third day, but sometimes the lesions about the mouth and tongue may be slight compared to those in the œsophagus. Almost without exception there is a history that the infant was a poor drinker and lost weight progressively, and that diarrhœa and vomiting, often severe, produced further dehydration. Interference with swallowing leads to under-nutrition and dehydration; the fungus and other organisms may be aspirated from lesions about the mouth and pharynx into the lungs, or a secondary bacterial infection may spread into the blood stream or into the mediastinum.

The lesions commence by the growth of mycelial filaments of the fungus into the squamous epithelium. Small elevations composed of mycelial filaments and spores of the thrush fungus and dead and dying epithelial cells become confluent to give an irregular white membrane, which may come to cover almost the entire œsophagus. This may be well marked also in the pyriform recesses of the pharynx. There is at first little inflammatory reaction in the sub-epithelial tissue, but when various bacteria become numerous and, especially, when the membrane breaks away carrying with it the epithelial covering, inflammation may extend into the wall of the œsophagus. Fibrin thrombi may then be found in dilated sub-epithelial blood-vessels, and œdema fluid and a few polymorphs in the loose peri-œsophageal

tissue will indicate a fatal mediastinitis. Sometimes the mycelial filaments appear to grow as strands into blood-vessels, but this must be regarded as a post-mortem artefact, and while lesions in the stomach and intestine occur it is doubtful if the fungus itself ever disseminates by the blood stream.

The risk of thrush infection is greatly increased by the pooling and sharing of microbic flora which is so difficult to prevent in hospitals and nursing homes. Aerial spread is probably not important, but 33 per cent. of nurses working with these infants were found to carry the organism in their pharynx and intermittently to contaminate their fingers. About 14 per cent. of the general population are mouth or throat carriers, and 20 per cent. of women carry the organism in the vagina (for literature see Ludlam and Henderson). The occurrence of the infection in breast-fed infants under the best conditions suggests that some of these sources should be considered as more important than the traditional dirty feeding bottles and teats. The early detection and prompt treatment of oral thrush with 1 : 100 gentian violet is essential. The tedious and difficult examination of the mouth cannot be omitted with any class of patient and, while the incidence of œsophageal thrush is low compared to that of oral thrush, only those who do routine necropsies will know how many infants they lose from neglect of this procedure.

Pneumonia.

It is important to distinguish pneumonia present in the dead-born and in infants dying during the earliest days of life from that occurring from the fourth day onwards. The first results from aspiration from the amniotic sac or vagina or is secondary to atelectasis resulting from the stress of birth. After the fourth day pneumonia results from causes independent of birth, and the infection reaches the lung either by the air passages or by the blood stream. Pneumonia may complicate some other condition, and should not be accepted too readily as the primary cause of death.

An interesting lesion is provided by neonatal aspiration pneumonia. Asphyxia in the infant in utero initiates respiratory movements and liquor amnii may be drawn deeply into the lungs. This is indicated by a large amount of cornified squamous epithelium and vernix caseosa in the alveoli. Such "drowned" babies are difficult to resuscitate, their wet air passages may not remain patent if respiration is feeble, and atelectasis may result. If the liquor is infected, or if infected material is introduced from the vagina or during efforts at resuscitation, a diffuse and widespread pneumonia with much congestion of capillaries and escape of red blood cells into alveoli and interstitial spaces may result. It is possible that the liquor, especially if it contains meconium, may sometimes excite an inflammatory reaction even in the absence of infection. This condition can only be distinguished from persistent congenital atelectasis by finding aspirated material in the lungs histologically. It can only be prevented by the elimination of fœtal asphyxia during the whole course of labour. The influence of artificial rupture of the membranes of prolonged dry labours, and of various obstetrical manœuvres has not yet been determined.

After the fourth day broncho-pneumonia predominates, but it may sometimes be extremely difficult to distinguish septic or embolic pneumonia resulting from blood dissemination of infection from another focus in the body from broncho-pneumonia, and especially from aspiration and staphylococcal pneumonia. Hæmorrhage and necrosis are common in all, and the degree of involvement of the peribronchial, perivascular and septal lymphatics may be equivocal. Small area of necrosis and hæmorrhage, secondary to infected thrombi lodged in small blood vessels, soon destroy so much tissue that relationships are obscured. A wide variety of organisms are responsible, even in broncho-pneumonia, and Macgregor (1939) has stressed the high incidence of *B. Coli*. Atypical and mixed infections may explain many of the disappointments encountered with modern chemotherapy.

Gastro-Enteritis.

This is one of the most unsatisfactory chapters in pathology. The first essential is to exclude a primary infection elsewhere. If this can be done a few cases will show nothing but congestion and œdema of the gut wall, some escape of red blood cells into the submucosa, some dilation of lymph channels, and perhaps some increased cellularity of the submucosa. The lesions always appear acute and terminal and yet the diarrhœa may have lasted for weeks. Similar lesions may be found in cases of diarrhœa where there is a definite infection elsewhere, and no histological change is known which provides any evidence that the infection originates in the gut. The most careful bacteriological investigations (e.g., Crowley et al., 1941) have entirely failed to reveal any specific microbe or even any distinctive intestinal flora. Various toxins elaborated in the body, or in the lumen of the gut, and not by any one bacterial species, might disturb the neuro-muscular and vasomotor control of the bowel, but no evidence can be produced and the experimental study of the problem is difficult. The extremely good, but inadequately controlled, results reported by Henderson (1943) after the use of sulphaguanidine should stimulate a thorough study of the effect of complete, or almost complete, bacterial sterilisation of the intestinal content by this agent or succinyl-sulphathiazole. Cases not responding, and free from parenteral infection, should be examined in great detail, remembering that a virus infection cannot be excluded. It is important to recognise that the mortality varies in different epidemics from nil to over 80 per cent. (Felsen and Wolarsky, 1942), and that excellent results from such therapy in an uncontrolled series of cases do not indicate that a bacterial infection of the gut itself is responsible.

Otitis Media.

Much has recently been written of otitis media as a reflex neurogenic cause of gastro-enteritis. In about 30 per cent. of autopsies some yellow muco-pus will be found in the middle ears both in cases with and without gastro-enteritis. It is usually scanty, not under any pressure, and the lining mucosa may be intact histologically. The infection is probably due to the unsatisfactory arrangement of the Eustachian tube and the presence of infected material or vomitus in the pharynx. The search for the cause of gastro-enteritis will not end thus easily.

Cryptogenic Septicæmia.

Cases of septicæmia without evidence as to the primary focus are very vexatious to the pathologist. Any undetected breach in the skin resulting from an eczematous or intertriginous erosion may allow organisms to invade the body. Some pathologists emphasise the importance of small erosions in the intestinal tract, and lesions about the nose and mouth are difficult to exclude. But in many cases both the portal of entry and the focus of blood dissemination must remain uncertain. One case died with paralysis of the lower limbs and after cutting many sections small abscesses were seen in the spinal cord and in the lungs, kidneys and heart muscle, but no primary focus of dissemination was found. It is always possible that with a very fulminant infection, even minute abscesses may not have time to form, and the cause of death will then remain obscure.

General Discussion.

Childbirth has been made reasonably safe for the mother by the efforts of countless practitioners, aided by laboratory workers and by the new chemotherapy. Present day housing conditions and the absence of domestic assistance have increased the demand for institutional midwifery. While not limited to institutional practice, neonatal infections are favoured by the increased number of potentially infectious contacts thus made. Everywhere the risk to the child is still distressingly high. The practitioners of to-day should recognise that there is no panacea for this either in the shibboleths of social reformers or in the latest chemotherapeutic agent. Only the dissemination and practice of good medical and nursing technique, based on exact scientific knowledge, will suffice. Much of this knowledge has still to be obtained, and many disappointments and vexations lie ahead. Strict asepsis during labour is as important for the baby as for the mother, and, since many agents non-pathogenic to older infants are potentially morbid to the infant, the greatest care must be taken that organisms are not conveyed either from other infants or from healthy adults. Carriage of infection by hands and by inanimate objects is far too often responsible, and must be stamped out by a rigorous system of barrier nursing. This will employ a more highly trained and more numerous staff than at present. Control of dust by some of the modern oiling techniques for the treatment of bedding and floors will do much to reduce the less important but still serious hazard of airborne infections. Without scientific control, effort and money will be wasted and our profession will have failed in its responsibilities.

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