iridocyclitis, in which the eye has reached a torpid and sluggish state, and which have progressed over long periods in spite of the usual treatment, may frequently be made to heal over and remain quiet after a course of three, four, or more exposures to light. The deep lesions of acne may also be very favourably influenced.

There are, however, two conditions wherein the beneficial effects of treatment are very evident: recurrent ulcers, and phlyctenular ulcers. With regard to the former, especially those marginal lesions associated with a continually relapsing conjunctivitis, the ulcer itself readily clears, an end which is, of course, usually easily brought about. But after the epithelium round the ulcer has been desquamated in the photophthalmic reaction following exposure to ultra-violet light, the new layer seems so healthy and resistant that it is enabled to withstand the liability to break down on future occasions. As a general rule the ulcer heals up after the first or second exposure, and in the milder cases heals up leaving a transparent facet; but it is preferable in most of these cases to give a third or fourth exposure, bringing about a mild reaction each time, involving a traumatism and renewal of the epithelium in order to render the possibility of recurrences more remote.

Acute phlyctenular ulcers occurring in children respond so well to general light treatment⁷ and efficient dieting and hygiene that it is not worth while, as a rule, to coax a child affected with this disease to submit to keeping its eye open in the beam of the slit-lamp. It is in the chronic cases which have gone on for years, leaving an ulcerated, opaque, and vascularized cornea, and involving continued irritation, frequently with acute exacerbations, that the

method has its greatest use. Here again it is best employed along with general light baths. In these cases the eye quiets down and becomes white and comfortable, but the extensive opacities, which are already present with the resulting diminution of vision, remain.

One word may be said with regard to corneal opacities. In order to investigate claims in the literature, a series of nine cases of old corneal opacities were given a fair trial with local radiation. No results justifying the continuation of the treatment were seen anywhere. It is certainly the case, however, that recent opacities, such as those following ulceration, may be improved, and the prophylactic action of the treatment of ulceration by light in the prevention of opacity formation is very marked. Two factors seem to enter into this: the rapidity of healing with new-formed epithelial cells, and the large amount of vascularization which the photophthalmic response excites. To this extent its action would seem to be comparable to that of an irritant, such as dionine.

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FOCI AND NATURE OF INFECTION IN 100 CASES OF RHEUMATIC CONDITIONS.*

BY

E. CRONIN LOWE, M.B.E., M.B., B.S.,

PATHOLOGIST AND BACTERIOLOGIST TO SOUTHPORT INFIRMARY AND
LIVERPOOL EYE AND EAR INFIRMARY.

(With Special Plate.)

It is now admitted that a large majority of rheumatic cases are due to some infective cause. Many types of organisms have been accredited with being the causal agents, but it has also been admitted that no one organism has proved to be the causal factor in more than a certain number of cases. Similarly, with regard to the focus held to be responsible in cases of infective arthritis and fibrositis: teeth, tonsils, accessory sinuses, gall-bladder, intestinal tract, and urinary and genital passages have all in turn fallen under suspicion as being the main or primary source of infection, and treatments designed to deal with these foci have sometimes been applied with good results, but more often without success.

It has generally been realized that while unhealthy and abnormal conditions of any of the areas above enumerated may be the cause of arthritis, fibrositis, myositis, neuritis, and other inflammatory conditions, it is exceedingly difficult to determine in any individual case whether the particular area under consideration is really the causal one, or whether it is only one of several equally important foci which may be present, but less obvious, in the patient. The bacteriological investigation of specimens from a patient suffering from some rheumatic infective condition, as indeed from an apparently normal person, will show numbers of varying strains of organisms in cultures made from teeth, tonsils, sinuses, post-nasal secretions, faeces, etc., and many of the isolated bacteria are of a possibly infective type and character. In the normal person they are obviously not so at the time, and the question arises of how to decide which, if any, are of infective importance to the patient under investigation. In the rheumatic case it is usually assumed that streptococci, if isolated, are probably causal, and past experience in treatment has certainly shown this conclusion to be frequently correct;

but the types of streptococci are many and various, and the question again arises as to whether they are all of equal importance to the case from which they have been isolated, or whether one or other strain is the real causal agent of the condition present.

A great deal of work has been done on the bacteriology of rheumatic infection during the past thirty years. Paine and Poynton¹ claimed the organism they isolated and named *Micrococcus rheumaticus* to be the specific infective agent; Andrewes and Horder² later recognized this organism as probably similar to the *Streptococcus faecalis*. Shaw,³ and later Beattie,⁴ demonstrated the presence of streptococci in the synovial membranes of cases of acute rheumatism, and with these experimentally reproduced arthritis and endocarditis in rabbits; Topley and Weir,⁵ however, showed that not only streptococci isolated from rheumatic lesions, but those from non-rheumatic sources, were capable of producing similar experimental lesions in rabbits. Warren Crowe⁶ described a staphylococcal type of organism, which he named *Micrococcus deformans*, and believed it was frequently a specific cause of infection in chronic infective arthritis. Bach and Wheeler⁷ have quoted many cases in which chronic intestinal infection, associated with the presence of atypical coliform organisms, has apparently been causal in certain forms of rheumatism. Ford Robertson,⁸ after giving his reasons for not accepting the *Micrococcus rheumaticus* as an adequate specific agent, detailed several different species—namely, *Streptococcus pyogenes*, *anginosus*, *salivarius*, *B. influenzae*, *pneumococci*, *diphtheroid bacilli*, and *Micrococcus catarrhalis*—which he considered were all capable of being causal agents in rheumatic infections. Some indecision exists, therefore, as to which, if any, of the numerous organisms isolated from a case may be pathogenic to the patient concerned, and, further, as to which organisms should be employed as an antigen in the condition, if vaccine treatment is desired.

In approaching the question of ascertaining the focus and bacteria concerned in rheumatic cases, these difficulties were appreciated, and in view of the satisfactory results obtained by means of the pathogen selective culture method in previous cases already published (Solis-Cohen⁹ and Cronin Lowe¹⁰), this method of bacteriological examination was carried out in a large number of cases which clinically fell into the group of rheumatic infections. An analysis of the findings in 100 of these cases is the subject of this communication.

* Communication read before the Wallasey Medical Society, March, 1929.

The pathogen selective method has been explained in detail elsewhere¹⁰; it depends upon employing the patient's freshly drawn blood to determine, by the presence or absence of efficient bactericidal power, whether any of the organisms present in suspected foci of infection are or are not pathogenic to the patient concerned. The method has several practical advantages. (1) It allows of many foci being examined at one sitting. In this group of 100 cases an average of three specimens in each patient was examined, the maximum being six and the minimum two. (2) It differentiates between foci which are causing systemic infection of the patient and those which are not doing so, at the time of examination. (3) It selects the organisms in such foci which are responsible for the systemic infection in certain cases, sometimes indicating one particular strain as the only important pathogenic agent in the patient infected.

The various specimens examined were classified according to the types of pathogen selective findings which resulted, and it was found that while a quarter of the total examinations gave evidence of a multiple or dual infection, and another quarter of no infection at all, practically half the specimens examined indicated that a single pathogenic micro-organism was the active infective agent. The appearance of these bacteriological results may be shown in the photographs of actual culture plates, demonstrating each of the findings enumerated. (Figs. 1 to 5.)

Clinically the cases of this series comprise infective arthritis 51, fibrositis 39, chronic neuritis 7, and sciatica 3 cases. In many of these cases full bacteriological examinations were made upon dental, tonsil, post-nasal, antral, intestinal, urinary and cervical (uterine) specimens wherever possible. An analysis of the specimens examined shows that in 20 cases two specimens were dealt with; in 55 cases three specimens; in 22 cases four specimens; in one case five specimens; and in 2 cases six specimens.

In Table I the number of cases in which more than one infective focus was shown to be present are detailed; in the lower section is shown how rarely a single focus is wholly responsible. These findings appear to emphasize

TABLE I.—Positive Pathogen Selective Findings in 100 Cases of Rheumatic Infection.

In 28 cases positive cultures occurred in 1 specimen only.	
In 47 " " " " " 2 specimens only.	
In 21 " " " " " 3 " " " "	
In 4 " " " " " 4 " " " "	

Thus in 100 cases positive cultures occurred in 201 specimens.

The 28 cases in which positive pathogen cultures resulted in one specimen only suggests that the foci responsible for infection were intestinal in 10 cases, post-nasal in 9 cases, tonsillar in 6 cases, and dental in 3 cases. In the remaining 72 cases more than one focus was responsible for, or contributed to, the generalized infection present.

the importance of making a wide search in any and every case of suspected infection, for frequently a pathogenic focus has been found in an area showing no clinical evidence of infection. It is possible that in the 28 cases with a single focus of infection cure of the disease might have been obtained by eradicating the focus, but it is almost certain that in the remaining 72 cases more extensive and more general means of treatment was called for.

Table II shows in more detail the numbers and percentages of positive pathogen selective findings obtained from various foci examined, and indicates that roughly two-thirds gave some type of positive findings and one-third gave negative results. It will be noted that very

TABLE II.—Comparative Frequency of Positive Pathogen Selective Cultures in Specimens Examined from Foci in 100 Cases of Rheumatic Infection.

Foci Examined.	Number Examined.	Positive Pathogen Selective Results in.
Post-nasal specimens ...	97	75 = 77%
Intestinal " ...	84	55 = 65%
Tonsillar " ...	57	37 = 63%
Dental " ...	47	29 = 62%
Antral " ...	9	2 = 22%
Urinary " ...	9	2 = 22%
Cervical " ...	5	1 = 20%
Total ...	308	201

few cervical examinations were made; there was, however, very little evidence of cervicitis, although it was inquired for in all women examined. The small percentage of pathogenic findings in catheter urine specimens is also of interest, confirming what has been emphasized elsewhere, that the mere presence of bacteria in a specimen of urine does not necessarily mean that they are an infective agent.

Table III further summarizes the relative clinical importance of potential infective foci as indicated by pathogen selective cultures in these 100 cases, and corresponds with

TABLE III.—Showing the Relative Clinical Importance of Potential Infective Foci in 100 Cases of Rheumatic Infection.

Foci Examined.	Number.	Positive Pathogen Selective Cultures in 308 Examinations.
Post-nasal specimens ...	97	37.5%
Intestinal " ...	84	27.5%
Tonsillar " ...	57	18.0%
Dental " ...	47	14.5%
Antral " ...	9	1.0%
Urinary " ...	9	1.0%
Cervical " ...	5	0.5%

the evidence of other observers that infective foci associated with the upper respiratory tract are the most frequently responsible for rheumatic infection conditions, while those of the intestinal tract come second, with tonsillar and dental foci taking third and fourth place respectively.

Table IV is introduced as a contrast, in which the completely negative pathogen selective findings resulted from similar examinations in 7 cases other than the 100 analysed, and in which subsequent clinical evidence confirmed that they were not cases of infective rheumatism.

TABLE IV.—Cases with Symptoms of Rheumatic Infection in which Completely Negative Pathogen Selective Cultures Resulted.

Case No.	Clinical Diagnosis.	Dental.	Tonsil.	Post-nasal.	Faecal.	Urinary.
250	Gout ...	—	—	0	0	—
201	Teno-synovitis ...	—	0	0	0	—
215	Diabetes ...	—	0	0	0	—
965	Neuritis ...	—	0	0	—	—
320	Chronic arthritis ...	0	0	0	0	—
417	Rheumatic myositis ...	0	0	0	0	—
2294	Traumatic spine ...	—	—	0	0	0

So far, I have attempted to indicate that it would appear possible to determine in cases of chronic infective disease which of several possible foci under consideration harboured bacteria capable of causing systemic infection to the patient concerned.

In Table V is shown a comparison of the incidence of organisms isolated by the pathogen selective cultures with their incidence in direct or ordinary cultures; the frequency with which they appeared in the various foci is also shown.

It would appear that while any organism may be pathogenic to a particular patient, the *catarrhalis*, diphtheroid, atypical coliform, and *B. influenzae* groups are comparatively rarely of pathogenic importance. The streptococcal, pneumococcal, staphylococcal, and coliform groups are not only the more commonly pathogenic organisms, but their percentage frequency in infective foci is about the same. Further, the pathogen selective culture method is not selective of one or other organism only, but, as demonstrated in these findings, it will select any of the ordinarily present strains to which the tissues of the patient have lost their bactericidal protection.

It has been objected to this form of examination that it is merely using an enriched and therefore selective medium. This contention is not borne out by these findings, for they clearly show that while the organisms have in some cases been isolated, they have with equal, or greater, frequency been inhibited. In some specimens one patient's blood is inhibitory to certain organisms and favourable to others, while the blood from another patient results in an exactly opposite selection; Solis-Cohen's view that these

E. CRONIN LOWE: FOCI AND NATURE OF INFECTION IN RHEUMATIC CONDITIONS.

FIG. 1.—Culture plate "A" showing multiple strains of organisms.
FIGS. 2 AND 4.—Culture plate "B" showing positive single pathogen selective cultures.
FIG. 3.—Culture plate "B" showing positive double pathogen selective cultures.
FIG. 5.—Culture plate "B" showing negative or sterile pathogen selective cultures.

G. D. F. MCFADDEN: CONGENITAL DIAPHRAGMATIC HERNIA.

FIG. 1.—Showing retracted abdomen before operation.

FIG. 2.—Appearance of abdomen after operation.

FIG. 3.—Radiogram of chest taken before operation. The left lung is collapsed, the heart shadow displaced to the right, and the gas-distended intestines are in the left pleural cavity.

FIG. 4.—Radiogram of chest ten days after operation. The left lung has expanded fully.

TABLE V.—Incidence of Organisms Isolated by Pathogen Selective Cultures in 100 Cases of Rheumatic Infection.

Specimens Cultured.			Catarrhalis Group.	Staphylococci.		Pneumococci.	Streptococci.		B. influenzae.	B. coli.	N.L.F.	Streptococci.		Staphylococci.	Diphtheroid Bacillus.	
				Albus.	Aureus.		Haemolytic.	Non-Haemolytic.				Haemolytic.	Faecalis.			
Dental... ..	47	A	42	5	5	20	41	27	7							
		B	1	0	0	10	25	9	1							
			2%	0		20%	72%									
Tonsil	57	A	50	11	10	14	42	46	7							
		B	0	4	7	10	20	21	2							
				19%		19%	72%									
Post nasal ...	97	A	88	23	17	31	63	64	6							
		B	8	19	11	17	43	32	3							
			9%	30%		17%	75%									
Intestinal ...	84	A							83	8	39	74	5	15		
		B							32	2	12	42	2	1		
									40%		64%		4%			
Antral	9	A	2	4	6	1	0	4	0							
		B	0	1	3	0	0	0	0							
Urinary	9	A							3	0	0	4	6	4		
		B							1	0	0	1	2	0		
Cervical	5	A							1	0	0	0	2	4		
		B							0	0	0	0	1	0		
Total isolations ...		A	182	43	38	66	146	141	23	87	8	39	78	13	23	
		B	9	24	21	37	88	62	6	33	2	12	43	5	1	
Percentage				0.5	56	55	56	60	44	30	38	25	30	55	8	4

"A" = Direct cultures. "B" = Pathogen selective cultures.

findings are dependent upon the presence or absence of efficient bactericidal power in the blood concerned appears to be confirmed by the details given above.

In Table VI is given the comparative frequency with which the various organisms detailed were isolated by the pathogen selective cultures, and it is of some interest to compare these findings, both as regards the organisms themselves and the numerical frequency of their isolation, with those of the many workers referred to earlier in this

TABLE VI.—Percentage of Total Pathogen Selective Cultures isolated from 100 Cases of Rheumatic Infection.

Streptococcus haemolyticus pyogenes	32%	66%
Streptococcus anginosus	20%	
Streptococcus faecalis (enterococcus)	14%	
Staphylococcus aureus	10%	18%
Staphylococcus albus	8%	
Pneumococci	12%	11%
B. coli	10%	
Non-lactose fermenters	1%	
Catarrhalis group	3%	
B. influenzae	2%	
Diphtheroid bacillus	0.3%	

paper and to note the significant correspondence. As would be expected, streptococci as a group occur most frequently, especially the haemolytic types, both *pyogenes* and *anginosus*, while the *Streptococcus faecalis* of Andrewes and Horder is next in importance. Practically all the organisms which various writers have accredited with infective importance in rheumatic conditions have been selected, in one case or another, as pathogenic to the patient concerned, and it is striking to find Ford Robertson's⁶ list of infective species in chronic rheumatism so closely and fully repeated.

SUMMARY.

1. One hundred cases of varying degrees and types of rheumatic disorder have been examined for evidence of focal and bacterial infection, employing the pathogen selective culture method.

2. An average of three specimens were examined in each case.

3. In 28 cases only one infective focus was suggested by the pathogen selective method from the several specimens examined in each case.

4. In 72 cases more than one focus was apparently responsible for some proportion of the infection.

5. Taking all the cases together the clinical importance of infective foci was shown to be in the following order: post-nasal and accessory sinuses first, then intestinal, tonsillar, and dental foci.

6. As regards the actual infective organisms the streptococcal group was markedly predominant, but practically any other commonly present organisms may be important in an individual case.

7. It is apparently possible to determine which or how many of various suspicious foci in any patient are infectious and which are not, and thereby radical or conservative treatment may be clearly indicated in any case.

8. The actual organisms present against which the patient has lost resistance and for which an adequate immunity should be developed is indicated, and makes possible the employment of rational and exact vaccine therapy.

No attempt is made in this paper to elaborate the results of treatment as shown by repeating pathogen selective cultures at later dates, but it is hoped to detail these very satisfactory results in a later communication.

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CONGENITAL DIAPHRAGMATIC HERNIA.

BY

G. D. F. McFADDEN, M.Ch., F.R.C.S. Eng.,

ASSISTANT SURGEON, ULSTER HOSPITAL FOR CHILDREN, BELFAST.

(With Special Plate.)

CONGENITAL diaphragmatic hernia is not a common condition, and it is rarely that a case presents itself with sufficient salient points for a diagnosis to be made in the clinical examination. The diagnosis can, as a rule, be made only in the x-ray department or in the operating theatre.

A boy, aged 4½ years, had been a premature child, and delicate since birth. He had no acute upset in his health till six weeks before he was seen by me at the Ulster Hospital for Children. In his first attack he suddenly screamed out with acute pain referred to the lower abdomen. He afterwards vomited. The pain and the vomiting continued and became more severe the following day. The bowels did not move even after repeated enemata. The third day the bowels moved and vomiting ceased. The pain lessened and finally disappeared. The boy was quite well till two weeks later, when he had a similar attack, which was less severe and lasted two days. Four days before I saw him he had another attack, from which he had not recovered when seen. This attack was like the others, but more severe. The mother had never noticed any fits of blueness or of breathlessness.

On examination the patient was seen to be a boy of delicate make, but not so ill as one would have expected a child to be with acute intestinal obstruction lasting four days. The colour was normal, with no signs of cyanosis. The pulse was 120, and the temperature normal. The abdomen was small and retracted, and appeared empty. The recti muscles stood out like a bow-string, especially during an attack of pain. The abdomen felt empty; no lump could be detected. The empty abdomen and the history of intestinal obstruction suggested the diagnosis of a diaphragmatic hernia. The chest showed diminished resonance over the base of the left lung, and the heart was slightly displaced to the right. There were no breath sounds to be heard