

SCARLATINAL ARTHRITIS;

A CLINICAL AND STATISTICAL STUDY.

PART I - CLINICAL  
Thesis for the degree of M.D.

by

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## INTRODUCTION

It is one of the compensations of work in a fever hospital, that, although dealing with a comparatively limited number of diseases, in addition to various conditions which may be traced to various infectious diseases, the scope of our observations in the field of medicine is considerably widened by the incidence of the complications which are a more or less constant feature of the same.

### PART I - CLINICAL.

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## I N T R O D U C T O R Y .

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From another point of view even the most modern and complete text-books show a certain amount of divergency of opinion in regard to certain clinical points that could be fairly easily cleared up by a little careful observation, and certain gaps in knowledge, especially from the statistical standpoint, that could be filled in after a little consideration of the abundant records available in the Edinburgh City/

City Hospital. The writer also originally set out with the intention of completing the work by making some bacteriological researches into the condition, but this was prevented by various circumstances, the main difficulty being that it was almost impossible to carry out this part of the work when not actually resident in the hospital.

Most modern fever experts have adopted the term "arthritis" in place of the old "rheumatism" and although this may have something to commend it from a scientific point of view, in so far as the modern term denotes a certain condition in certain tissues, the old term had its conveniences, for it could be held to include associated inflammations in tendon sheaths and muscular tissues as well as in joints - so obviously manifestations of the same process that the new habit of separating them into arthritis, tendosynovitis, and myositis, seems clumsy by comparison. Reference to this point is rendered necessary by the fact that in all statistical considerations the use of the term arthritis is held to include these other manifestations as well.

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PATHOLOGY OF SCARLATINAL ARTHRITIS.

The inflammatory reaction in a joint affected with scarlatinal arthritis does not in any way differ from that shown in several other infective conditions, e.g. gonorrhoea, typhoid and measles<sup>1</sup>, acute rheumatism<sup>2</sup>, or again the reaction following the administration of serum<sup>3</sup>. It is usually described as serous arthritis<sup>4</sup>, but it would appear that the process may extend a stage further in a certain number of cases, as in one case of the writer's where the pyrexia was marked, the pain a prominent symptom, together with a definite swelling of the knee joint, the fluid after drawing off was distinctly turbid in character, containing many leucocytes and on standing showed one or two small flakes of fibrin, pointing to the fact that the reaction was of the sero-fibrinous type. In addition to these two types McClure<sup>5</sup> and C.B. Ker<sup>4</sup> describe cases that have gone on to actual suppuration but the writer's series of cases, including all the cases of Scarlatinal arthritis occurring in the Edinburgh City Hospital in a period of over eighteen months, do not include any of this type and Dr Ker's experience is that they are very unusual.

As a rule in the serous variety the pathological changes in the joints are mild, consisting of a moderate/

moderate increase of fluid within the joint, the exudate being thin and fluid with a few leucocytes in it. There is swelling and injection of the synovial membrane, with a slight infiltration, mainly of the villi, with polymorphonuclear leucocytes<sup>6</sup>. The surfaces of the articular cartilages are also injected. In addition a similar change occurs in the tendon sheaths in the neighbourhood of the joint, and indeed this periarticular reaction may often be the more prominent, giving rise clinically to the signs of a teno-synovitis.

Where the reaction proceeds to the sero-fibrinous type, the joint cavity is filled with an increased amount of turbid fluid, the turbidity being due to an increased migration of leucocytes in the fluid. In the recesses of the synovial sac or on the joint cartilages a fibrinous deposit is laid down, but this in the vast majority of cases goes on to complete resolution later.

Suppurative arthritis may follow or be associated with the above forms of inflammation and here the exudate is definitely purulent and contains pyogenic organisms.

The teno-synovitis occurring in tendon sheaths adjacent to the sites of the arthritic process has been/

been described practically when dealing with the peri-articular changes. There is no tendency in the scarlatinal form of the infection to the formation of adhesions.

The pathological changes underlying myositis are imperfectly understood and would appear to be an inflammatory reaction affecting mainly the supporting structures leading to a proliferation of the connective tissues.

#### CLINICAL MANIFESTATIONS OF SCARLATINAL ARTHRITIS.

Scarlatinal arthritis generally appears with the decline of the fever, its first manifestation being stiffness or actual pain in one or more joints or muscles together with some constitutional disturbance in the shape of a rise of temperature and pulse rate, if these have already fallen. This is followed very soon after by swelling of the affected joint or joints and the condition either remains more or less stationary for about a day, at the end of which time the pain is usually decreased and the other symptoms begin to abate, or other joints begin to be involved and go through the same gamut of changes, the temperature usually remaining up till fresh involvement of joints has/

has ceased. With the swelling the joint feels hot and tender and the patient keeps it fixed in some position in which the structures are relaxed, this leading to a certain limitation of movement. As recovery takes place the pain and stiffness gradually disappear, not in any particular order, the various joints in any one case showing marked individual differences in the degree of involvement as measured by the symptoms, and it is usually the most painfully affected joint which is the last to clear up. In contrast to acute rheumatism the condition does not subside in one joint on passing to another. Altogether scarlatinal arthritis is a somewhat transient condition and the prognosis is good, the patient returning to a normal convalescence in a few days.

Onset. Whatever determines the onset of this condition there is little doubt that the case of scarlet fever showing arthritis is usually a typical one in which the premonitory symptoms of headache, vomiting and sore throat have been well marked, the rash a bright one, and the constitutional disturbances associated with the fever well developed. It is unusual for the mild or atypical case to develop arthritis. Efforts have been made to link it up with the condition of the throat and in the examination of cases actually observed by the writer special attention was/



was directed to this point in thirty-three cases. Marked pain, great congestion of fauces, and tonsils, enlargement of the tonsils and some degree of patching or ulceration were taken as the criteria of what the clinician generally sums up as a "dirty" throat, and of these thirty-three cases of arthritis, seven only fell into this category. The remaining twenty-six were typical scarlet throats showing faucial congestion with perhaps slight enlargement of the tonsils. In the absence of a control on "dirty" throats which did not show arthritis, the institution of which would have been almost an impossibility to arrange so that allowance could be made for such factors as differing degrees of susceptibility at the various age periods, this may not seem a very critical observation but it is a suggestive point that more than three quarters of this series of cases showed no more than the average local disturbance in the throat. A previous history of rheumatism would seem however to be a definite forerunner of an attack of arthritis in scarlet fever, as, out of thirty patients who developed arthritis in the course of scarlet fever, five gave a definite previous history of rheumatism, and a sixth a history of occasional joint pains. Considering the incidence of rheumatism on the general population this may be held to be a fairly conclusive figure. In these cases it is/

is most interesting to note that in all cases the arthritis appeared with one exception within the first seven days; that is, they may be regarded as true scarlatinal arthritis from the standpoint of the time of their onset in the course of the disease. The remaining case appeared in the fourth week, so that the possibility that we are dealing with a coincident true rheumatism cannot be excluded. In two cases that had received 8000 and 4000 units of diphtheria antitoxin within a few days previous to scarlet fever developing, arthritis appeared on the 7th and 3rd days respectively from the onset of the Scarlatina.

The actual onset of the complication occurs during the period of defervescence of the fever, when the rash is beginning to fade and the temperature has fallen to normal or is showing definite signs of doing so. It is generally gradual and very often appeared on waking in the morning in the form of a slight stiffness on movement which gradually merges into pain as the day goes on, a rise of temperature the previous evening having foreshadowed the onset. Frequently however pain and swelling come on fairly rapidly and the accompanying rise of temperature is quite steep, the attack in this case being likely to be quite a sharp one, causing a considerable amount of suffering to the patient from the beginning. It is doubtful if there/

there is any association between the time of appearance of the arthritis and the severity of the attack. Occasionally in studying a case that has occurred early in the fever one has been inclined to consider that the various symptoms are more marked and the degree of involvement wider, but making allowance for contributions to the clinical picture other than arthritis and then making comparison with cases occurring a few days later, one has come to the conclusion that this is not the case.

**Pain:** This is very often the first symptom that draws attention to the appearance of an arthritis. The temperature may have risen but until the pain declares itself in a joint it may not be evident what is the cause of the pyrexia. It comes on gradually and is noticed by the patients in performing some action such as supporting themselves in bed or in trying to grasp something. It may be very acute in character especially when it is chiefly situated in the muscular tissues, but the same might be said even when in joints and pain has been seen in the case of a hip-joint in a child, severe enough to warrant an opiate. This is exceptional however and in only a few cases is it bad enough to prevent sleep. As a rule it is described as a dull or gnawing pain, worse on movement and in many cases it never amounts to more than/

than a feeling of stiffness. One result of the pain is the production of a curious helplessness which, when for example the wrist and metacarpo-phalangeal joints are involved, prevents the patient grasping anything small in diameter, such as a pencil.

The pain may be continuous but frequently is only present on movement and the patient usually seeks some position of the affected joints which will give him some relief. For this reason the knee is kept slightly flexed, the ankles extended, the elbows flexed, the wrists extended and the fingers flexed. Some patients complain that the pain is worst at night when they get thoroughly warmed up, but others again have asserted that if an affected joint becomes exposed to the cold air when the cotton wool dressing usual in this condition is being changed, the pain becomes worse. In a very few instances joint pain has been the only evidence of the incidence of the complication.

The site of pain may occasionally be misleading. One patient complained of pain in the forearm only on the movement of pronation and at first this was regarded as a myositis, probably in the pronator teres. On further investigation however it became evident that the elbow joint was the locus of the pain and the radio-ulnar joint the starting point. In the investigation of pain in a joint the writer has attached some/

some importance to the presence or absence of pain in both active or passive movement and he has repeatedly seen instances where there was definite pain on active movement but little or none on passive movement, the inference being that in this form a teno-synovitis was the predominant factor.

The intensity of the pain is not generally carried over more than one or two days, the original pain giving place to a feeling of stiffness which may be more pronounced in the morning. This also passes off in the course of a day or two. Several adult patients who showed arthritis as a complication on being questioned when they were getting up for the first day or two, have reported a recrudescence of the stiffness but since this could be said equally truly of almost any patient after scarlet fever it does not affect the general statement that recovery is invariably complete. In one instance however the writer was able to follow up the case of a personal friend who suffered rather severely from arthritis in the early stages of scarlet fever and who has mentioned frequent twinges of joint pain over a period of six months since discharge from hospital, there being no history of rheumatism anterior to the onset of the scarlatina.

**Tenderness:** This is not a feature of scarlatinal arthritis and patients submit quite readily to the handling/

handling of a joint. Where however there is much in involvement of the tendon sheaths in the neighbourhood there may be a certain amount of pain on pressure along the course of the tendons involved, and this is particularly the case when the tendons on the back of the hand and round the wrist and ankle joints are the seat of an inflammatory process.

**Swelling:** This sign is by no means a constant one and out of forty-nine cases investigated on this point no fewer than thirty showed other definite symptoms and signs of arthritis in several joints without swelling appearing at any time in the course of the complication. Thus over half the patients did not show this sign and these included many wrist, finger, and knee joints which are easily examined in this respect. Small degrees of enlargement in such joints as the shoulder are not so readily made out however and a few may have escaped on this account. The remainder showed swelling in one or other of the joints affected but this was by no means present in all of them. When swelling does appear it is not very great in amount except in fairly severe cases, and even in these there is not the deformity that is seen in acute rheumatism. The joints that show this feature most obviously, as stated above, are the small joints about the fingers and wrists and the knee, and generally/

generally the swelling, especially in the former, seems to be chiefly in the periarticular tissues, which become puffy-looking but do not pit on pressure. It is not an early symptom either, possibly not being evident till pain has been present for a day or so, and it usually passes off whilst the other symptoms of pain and stiffness remain to show that the arthritic changes are not quite at an end. Unlike some other forms of arthritis the swelling does not disappear from one joint on another being involved in the same way, resembling pain in respect of the fact, that, where the reaction in the form of swelling has been greatest will be the site from which the swelling will take the longest to pass off. With regard to the association between pain and swelling it may be stated that the writer has seen several cases where the pain was acute, but there was no swelling from beginning to end of the process. Indeed in one case where one joint only, the right wrist, was involved, the patient complained of being unable to sleep on account of the pain, but no swelling whatever appeared.

Redness: Occasionally a faint blush has been observed round a joint in which an arthritic process was proceeding, but on investigation this always proved to be the result of massage or the application of/

of a rubefacient just previously. Generally speaking redness of the joints in scarlatinal arthritis may be said never to occur.

Heat. This is a very constant clinical sign and is usually obvious on palpation of the affected part in practically every case even when several of the other classical signs of inflammation are not well developed on account of the mild nature of the attack. We have seen that some of the other signs are liable to be masked where the joints are covered with muscular tissues and for the same reason heat can be most readily perceived in such accessible joints as the wrist, ankle, and knee. Even in the small finger joints it can be made out on careful examination. It appears early in the complication and passes off in the course of twenty-four or forty-eight hours. Frequently heat, in association with a rise in temperature and pain are the only clinical manifestations of scarlatinal arthritis.

Temperature: A rise of temperature is usually associated with arthritis but this sign of constitutional disturbance was absent no fewer than seven times in forty-nine cases that the writer has observed on this point. One of these seven cases was quite

a/



a sharp arthritis, the shoulder, elbow, wrist and hand all being affected, and in addition there was a definite myositis in the biceps and muscles of the forearm. In most of the other cases showing no temperature however, the arthritis was of a mild type.

The usual sequence of events is either for a temperature to appear with pain as the first warning of joint trouble, or the rise of temperature may be the very earliest indication, the pain appearing a little later in one or more joints. The interval between the onset of the temperature and the occurrence of the joint pain may be quite an appreciable one however, and in two of the most marked instances of this the arthritis did not declare itself till there had been a temperature of 100<sup>o</sup>F. for two days in one case, while in the other it did not do so for three days. In the former case the child was aged 10, and in the latter 12, so there could hardly be any question of inability to make the condition known. Less striking instances of this phenomenon are quite common and cases have been seen fairly often in which there might be a flicker of temperature of half a degree or so, say in the evening, with a return to normal next morning, following which there is a more definite rise of two or three degrees next evening together with the/

the onset of joint symptoms.

The rise of temperature, apart from the premonitory flickers described above is usually a fairly steep one and may be anything up to  $101^{\circ}\text{F}$ . or  $102^{\circ}\text{F}$ . The behaviour of the temperature curve now depends on the severity of the process. In a very mild case the temperature will be down to normal in twelve hours, the total constitutional reaction being represented by a single peak. In more severe cases the temperature will remain in the neighbourhood of  $100^{\circ}\text{F}$  or  $101^{\circ}\text{F}$ . for two or three days and then rapidly drop to normal, or, as a variation of this, it may come gradually down from the initial rise over a period of two or three days. In cases of a similar amount of severity still another variation may occur. There may be a definite rise of temperature to  $100^{\circ}\text{F}$ . or thereabout, followed by a return to normal or nearly so, in twelve hours, the process being repeated with the fresh involvement of joints so that the whole course of the complication is represented by a number of peaks according to the number of joints involved. In cases occurring early, before the initial temperature of the scarlet fever has had time to fall to normal, the usual course of the defervescence is changed. Instead of gradually coming down by lysis the temperature/

temperature is kept up a few days longer, at the end of which time it usually comes down somewhat abruptly and remains subnormal except for one or two minor flickers. Where the arthritis occurs in the course of a septic case there is little or no modification of the temperature curve that is characteristic of that type of the disease, and the onset and clearing up of an arthritis may leave no trace of its presence on the temperature chart. The maximum temperature ever observed by the writer in a case of scarlatinal arthritis was in a septic case in which for a few days previous to the appearance of the complication the temperature was oscillating between  $100^{\circ}\text{F.}$  and  $102^{\circ}\text{F.}$  With the arthritis it shot up to  $104.6$  but was back to its previous level in twelve hours. Other occasions on which particularly high temperatures of  $103^{\circ}\text{F.}$  or  $104^{\circ}\text{F.}$  were noted were when the arthritis appeared in the early stages of the fever before the temperature had fallen any appreciable amount.

The duration of the temperature may be anything from two to five days and in a series of fifty-three female cases where the arthritic temperature was uncomplicated by a temperature traceable to any other source so that the duration could be accurately measured, thirty-nine of them ranged between the above limits. In fifty male cases observed on the same basis/

TABLE SHOWING JOINTS INVOLVED IN 92 CASES, EXPRESSED

basis, forty-two ran two, three, four or five day temperatures. In that series the longest duration of a scarlatinal arthritis temperature was seventeen days and occurred in a female, but usually, where the temperature becomes as prolonged as this, one would search for a previous rheumatic history. With the fall of temperature there is generally a cessation of the more acute manifestations of the arthritis, but possibly slight pain on movement, or more likely, stiffness in the affected joints may remain for a day or two after the temperature has returned to normal.

Pulse: The pulse rate, where there is arthritis, runs hand in hand with the temperature and has no special significance in itself. On the rare occasions when heart complications follow arthritis there may be a high pulse rate during the arthritis but this in itself would hardly be an indication in all cases of arthritis that there was an impending heart lesion, and one would be attracted to such a case by one or other of the more typical signs of cardiac involvement.

TABLE I.

Arthralgic	Arthritic	Total
1	1	2
2	1	3
3	1	4
4	1	5
5	1	6
6	1	7
7	1	8
8	1	9
9	1	10
10	1	11
11	1	12
12	1	13
13	1	14
14	1	15
15	1	16
16	1	17
17	1	18
18	1	19
19	1	20
20	1	21
21	1	22
22	1	23
23	1	24
24	1	25
25	1	26
26	1	27
27	1	28
28	1	29
29	1	30
30	1	31
31	1	32
32	1	33
33	1	34
34	1	35
35	1	36
36	1	37
37	1	38
38	1	39
39	1	40
40	1	41
41	1	42
42	1	43
43	1	44
44	1	45
45	1	46
46	1	47
47	1	48
48	1	49
49	1	50
50	1	51
51	1	52
52	1	53
53	1	54
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56	1	57
57	1	58
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59	1	60
60	1	61
61	1	62
62	1	63
63	1	64
64	1	65
65	1	66
66	1	67
67	1	68
68	1	69
69	1	70
70	1	71
71	1	72
72	1	73
73	1	74
74	1	75
75	1	76
76	1	77
77	1	78
78	1	79
79	1	80
80	1	81
81	1	82
82	1	83
83	1	84
84	1	85
85	1	86
86	1	87
87	1	88
88	1	89
89	1	90
90	1	91
91	1	92

TABLE SHOWING JOINTS INVOLVED IN 49 CASES, EXPRESSED  
AS A PERCENTAGE OF ALL JOINTS ATTACKED.

Joints.		Male	Female	Total.	Percentage of Total.	Combined per- centages for some joints.
Wrists.	R.	8	24	32	13.67	27.34
	L.	8	24	32	13.67	
Interphalangeals of Hand.	R	3	8	11	4.7	22.20
	L	2	14	16	6.83	
Metacarpo- Phalangeals.	R	3	9	12	5.12	
	L	2	11	13	5.55	
Knees	R	5	14	19	8.12	14.52
	L	4	11	15	6.40	
Shoulders	R	5	12	17	7.26	14.09
	L	4	12	16	6.83	
Elbows	R	2	13	15	6.41	12.82
	L	3	12	15	6.41	
Ankles	R	1	7	8	3.41	7.25
	L	2	7	9	3.84	
Temporo- Mandibular	R	-	-	-	-	0.42
	L	-	1	1	.42	
Interphalangeals of Foot.	R	-	-	-	-	0.42
	L	-	1	1	.42	
Hip	R	-	-	-	-	0.42
	L	-	1	1	.42	
Metatarso- Phalangeal.	R	-	-	-	-	0.42
	L	-	1	1	.42	

TABLE SHEWING ANALYSIS OF JOINTS INVOLVED.

Joints.	Involvement of Males per cent.		Right + Left	Involvement of Females per cent.		Right + Left
	R	L		R	L	
Wrists	R	15.38	30.76%	R	13.18	26.36%
	L	15.38		L	13.18	
Interphalangeals of Hand.	R	5.77	9.61%	R	4.39	12.08%
	L	3.84		L	7.69	
Metacarpo- Phalangeals.	R	5.77	9.61%	R	4.94	10.98%
	L	3.84		L	6.04	
Knees	R	9.61	17.30%	R	7.69	13.73%
	L	7.69		L	6.04	
Shoulders	R	9.61	17.30%	R	6.59	13.18%
	L	7.69		L	6.59	
Elbows	R	3.84	9.61%	R	7.14	13.73%
	L	5.77		L	6.59	
Ankles	R	1.92	5.76%	R	3.84	7.68%
	L	3.84		L	3.84	
Temporo- mandibular	L	-	-	L	.54	0.54%
Interphalangeals of Foot.	L	-	-	L	.54	0.54%
Hip.	L	-	-	L	.54	0.54%
Metatarso- Phalangeal	L	-	-	L	.54	0.54%

Joints Involved. A table (Table I) has been prepared to show the incidence of scarlatinal arthritis on the various joints in the forty-nine cases personally observed by the writer at the Edinburgh City Hospital, the joints being arranged in their order of susceptibility to attack. From this table it will be seen that the commonest joints to be attacked are the wrist joints and the combined groups of interphalangeals of the hand and the metacarpo-phalangeals, the latter two being added together in view of their close relationship. Taken together the joints of the wrist, hand and fingers account for nearly 50% of all joints involved. Another group attacked with an almost equal degree of frequency is formed by the knees, shoulders, and elbows. Lastly the ankles would appear to be least commonly affected. Other joints are involved in rare cases but slumping these together they account for only a fraction over one and a half per cent of the whole.

Another table (Table II) has been drawn up with the object of further analysing these figures, to find out if there was any difference between the incidence of the complication in one sex as compared with the other, but a glance at the table will show that the joints affected most commonly in males are correspondingly/

correspondingly affected in females. A further point upon which information was desired was whether one side of the body was more liable to attack than the other, but from the figures it will be seen that each side of the body suffers equally. In males 51.9% of the joints affected belong to the right side and 48.05% to the left, while in females the corresponding figures were 47.77% and 52.13% respectively.

McClure gives some interesting figures relative to the proportion of joints attacked<sup>8</sup> but since he divides up his cases into percentages occurring at various week periods it is difficult to arrive at the exact percentages of the joints involved in his whole series of cases. By combining the data from two of his tables and working from that, it would appear that 36.9% of the joints involved were fingers and wrists, 17.8% were elbows, and 17.7% were knees. He does not state what were the proportions of shoulders and ankles involved. Foord Caiger does not give actual figures but states<sup>11</sup> that scarlet arthritis is "more frequent in the smaller than the larger joints; the arms suffer more frequently than the legs; the hands and wrists than the elbows and shoulders; and the ankles than the knees or hips. Most frequently of all it appears in the metacarpo-phalangeal joints, the wrists and fingers .....". The writer's figures/



figures agree with McClure in so far as he finds the highest incidence in the wrists and fingers and makes the elbows and knees almost equal. A comparison of the writer's figures with Foord Caiger's statements will reveal a very close similarity in practically all points, except that referring to the incidence in ankles as compared with knees. In the writer's series the incidence in knees was double the incidence in ankles.

Why the joints should arrange themselves in this order of liability to attack is not quite clear. Harrison<sup>7</sup> states that a gonorrhoeal arthritis or tenosynovitis is particularly liable to settle in an injured joint or an overworked tendon, and on this analogy it might be within reason to suppose that the order of liability to attack is simply the order of frequency with which a patient lying in bed uses his various joints. If this were true one would expect a greater involvement of the right side than the left, since most people are right-handed, but this is not supported by the facts as we have seen above that the right and left sides are almost equally involved.

This incidence chiefly in the small joints about the wrists and fingers would therefore appear to be a characteristic of scarlatinal arthritis, which in this respect differs markedly from acute rheumatic polyarthritis, /

TABLE III.

24a.

TABLE SHOWING PERCENTAGE OF JOINTS INVOLVED OUT OF ALL JOINTS  
AFFECTED AT VARIOUS AGE PERIODS.

	Inter- phalangeals of Hand.	Metacarpo- phalangeals	Wrists	Elbows	Shoulders	Ankles	Knees.
0 - 5	22.22%	22.22%	22.22%	-	-	-	33.33%
5 - 10	8.82%	8.82%	29.41%	14.7%	4.41%	11.76%	22.05%
10 - 15	15%	12.5%	27.5%	12.5%	17.5%	5%	10%
15 - 20	10.34%	3.44%	34.48%	6.89%	10.34%	27.24%	27.24%
20 - 30	13.79%	10.34%	29.31%	15.51%	22.41%	3.44%	5.17%
30 +	11.11%	18.51%	14.81%	14.81%	25.92%	-	14.81%

TABLE IV.

TABLE SHOWING WHETHER JOINTS INVOLVED SYMMETRICALLY OR ASYMMETRICALLY

	Female.	Male.	Total.
S	16	7	23
S + A	13	3	16
A + S	2	-	2
A	5	3	8

S = completely symmetrical, A = completely asymmetrical.

S + A = most joints symmetrical, one or two asymmetrical.

A + S = most joints asymmetrical, one or two symmetrical.

polyarthrititis, a disease tending to affect the larger joints<sup>9</sup>. For the sake of comparison one might quote the statistics of Pemberton and Robertson who investigated 400 cases of acute rheumatism in American troops. The sites of most frequent involvement were the knees - 67%, the ankles - 35.25%, the hip - 33.75%, and the shoulder - 31.75%<sup>10</sup>.

The point was also investigated as to whether there was any variation of the site of involvement with the age of the patient and the results of this investigation are shown in the table of the percentages of joints involved out of all joints affected at various age periods. (Table III) From this it will be seen that there is no disposition on the part of the complication to change its site of election with the age period, the small joints being predominantly attacked always.

That scarlatinal arthritis is usually symmetrical in its distribution will be seen from the included table. Out of 49 cases observed on this point 23 were completely symmetrical and 16 practically so, while only 8 were completely asymmetrical and 2 incompletely so. (Table IV).

McClure<sup>8</sup> mentions that as the arthritis falls later in the attack of scarlet fever there is a gradual increase in the percentage of the larger joints/

TABLE V.

TABLE SHOWING PERCENTAGE OF JOINTS INVOLVED OUT OF ALL JOINTS AFFECTED  
IN VARIOUS WEEK PERIODS.

	Wrists	Interphalangeals and Metacarpo-Phalangeals	Knees	Shoulders	Elbows	Ankles.
1st week	29.65%	21.37%	14.48%	13.79%	13.10%	7.58%
2nd week	14.80%	22.20%	22.22%	14.80%	18.51%	7.40%
3rd week	40%	6.66%	20%	13.33%	20%	-
4th week	21.73%	43.47%	8.69%	17.39%	8.69%	-
4th week +	30%	10%	20%	5%	15%	20%

joints involved, and tabulates his series of cases which bring out this interesting point very clearly in the particular joints selected, viz., wrist and finger joints, elbow and knees. A similar table (Table V) was made out with the present series of cases but including all the joints, i.e. the above mentioned with the addition of shoulders and ankles. The results obtained were by no means corroborative of McClure's results, but the present series of cases is so much smaller in number that his results cannot be said to have their validity impaired.

The average number of joints involved per person works out at 4.77, the males showing an average of four and the females a trifle over five. In the males the smallest number of joints involved was 1 and the highest 8, whereas the figures in females ranged from 1 to 11. It would appear therefore that the joints of females tend to be more extensively involved by scarlatinal arthritis than those of the male sex. The average number of joints involved, viz. 4.77, makes an interesting comparison with the average number involved in acute rheumatism which, according to Willcox<sup>12</sup> is three. There is no diminution of the extent of involvement according to the date of the incidence of the complication. Over the whole series of cases the number/

number of joints involved per person where the complication took place in the first week of the scarlet fever works out at an average of 4.9, in the second week 4.5, in the third week 3.75, in the fourth week 4.8, and in attacks after that, 5.25.

Duration of the Attack, In 48 cases where this could be ascertained with accuracy, the average duration of the attack was 5.9 days, the shortest attack lasting one day, and the longest, fifteen days. In males the duration was slightly less, 5.5, whilst in females it worked out at exactly 6 days. The cases were divided up into weekly periods according to the date of their incidence in the disease and it was found that the average duration was 6 days in cases beginning in the first week, 6.6 days in the second week, 4.6 days in the third, 5 days in the fourth, and 5.5 days for cases occurring after the fourth week. With regard to the age of the patient, for the age group below ten years, the average duration was 5.8 days, between ten and twenty 6.3 days, and between twenty and thirty 5.9 days. From these statistical considerations it would appear that none of the factors of sex, time of incidence in the attack of scarlet fever, or age of the patient, had any effect on the duration of the complication.

MYOSITIS.

Out of the forty-nine cases observed, eleven showed definite myositis in addition to arthritis, nine females and two males. The majority of the females were above twenty years of age, only two being younger than this. Both males affected were under ten years of age. The commonest groups of muscles affected were the muscles of the arm, particularly the biceps, and the forearm, which were involved in five cases, and the quadriceps femoris which was involved in three. Calf muscles were involved twice while the lumbar muscles, the trapezius and the sterno-mastoid were each involved on one occasion. No cases were observed, in which myositis appeared as the only evidence of rheumatism.

T R E A T M E N T.

In every case the patient had local applications of oil of winter green which is routine treatment in the Edinburgh City Hospital for scarlatinal rheumatism. Many derive comfort from this application but, apart from the psychological effect, whether this is due to the/



the counter irritant effect on the skin of the part or to the actual absorption of the salicylate through the skin is difficult to say. Absorption does occur through the skin<sup>22</sup> but given by the mouth, when the results might be expected to be more certain and rapid, the action of salicylates is disappointing as compared with their almost specific effects in acute rheumatism. Sixteen cases of the series were treated with salicylates internally, the average duration of the illness being 6.2 days as compared with 5.9 days over the whole series, and extensions to other joints and recurrences took place in eight of the cases after the treatment with salicylates had been started, this despite the fact that one of these cases was selected on account of a previous history of rheumatism and therefore likely to be benefitted by salicylates. In six cases there was no further involvement of joints and the temperature came down in two or three days. One case treated by aspirin yielded almost at once, the pain in the joints and temperature disappearing in the course of twenty-four hours. In the case which went on to endocarditis and pericarditis salicylates had been employed from the onset of the arthritis which preceded these complications. From this small number of cases it is very difficult and probably unwise to come to any conclusion in the matter, but so far as it goes/

goes it would appear that salicylates make little or no difference to the course of the complication. This is the opinion of Ker<sup>4</sup>, and McClure<sup>5</sup> states that his experience is that "the salicylates internally exercise no specific influence on the pain or the cause of the attack as in acute rheumatic fever". Caiger<sup>11</sup> on the other hand states that scarlatinal arthritis is "readily amenable to the action of salicin and the salicylates" and uses this opinion as one of his reasons for regarding scarlatinal arthritis as "pathologically akin" to acute rheumatism.

Redness and swelling. Feeling of heat in affected joints. Temperature 100.2. P. 108.

R. E.

7th day. Arthritis now extends to both wrists, right knee. ----- ria and calf muscles. Pain very acute in the wrists and still present in joints originally involved.

11th day. No further involvement of joints and pain and stiffness completely gone. T. Subnormal.

Treatment: Methyl Salicylate packs to affected joints.

Patient stated she derived great comfort from that.

Note. No swelling appeared in any of the affected joints. Myositis.

C A S E S.

E. H., female, aet. 18.

Admitted Ward IIIa with Scarlet fever in the 2nd day of disease, a fairly sharp case. No previous history of rheumatism in self or family. Throat on admission showed congestion of fauces and soft palate with slight enlargement of tonsils. No adenitis.

4th day. Arthritis. Pain and stiffness in fingers of both hands, both elbows, left knee, left ankle and left metatarso-phalangeal joints. No redness nor swelling. Feeling of heat in affected joints. Temperature 100.2, P. 108, R. 20.

7th day. Arthritis now extends to both wrists, right knee. Myositis in quadriceps femoris and calf muscles. Pain very acute in the wrists and still present in joints originally involved.

11th day. No further involvement of joints and pain and stiffness completely gone. T. Subnormal.

Treatment: Methyl Salicylate soaks to affected joints.

Patient stated she derived great comfort from that.

Note. No swelling appeared in any of the affected joints. Myositis.

N. W., male, aet. 17.

Admitted Ward II with scarlet fever in 3rd day of disease, a mild case. No previous history of rheumatism in self or family. Throat on admission very slightly infected. Slight adenitis.

4th day. Arthritis. Pain in both wrists and both ankles, worse on passive movement. No redness nor swelling. Joints hot to the touch.

T. 100.8. P. 102. R. 20.

7th day. No extension of arthritis. Only stiffness remains in the affected joints. T. 99. P. 80. R. 18.

8th day. Temperature normal. Still slight stiffness in ankle joints.

10th day. Arthritis completely cleared up.

Treatment. Methyl salicylate soaks to affected joints. Pain easier after this application.

Note: No swelling in affected joints.

-----  
Slight adenitis.

J. G., male, aet. 25.

Admitted Ward II with scarlet fever in 4th day of disease, a mild case. No previous history of rheumatism in self or family. Throat on admission red. Slight enlargement of tonsils. No adenitis.

9th day. Arthritis. Pain in both shoulders, worse on movement. Slight heat on palpation. No swelling or redness. T. 99.8. P. 90. R. 18.

13th day. Pain still present in shoulders. Slight twinge in R. elbow which shows no physical signs. T. 99.2. P. 85. R. 18.

14th day. Pain quite gone from all joints.

T. 98. P. 80. R. 18.

Treatment: Methyl salicylate soaks to affected joints.

Note. A mild case of scarlet and a mild arthritis.

W. B., male, aet. 19.

Admitted Ward II with scarlet fever in the 3rd day of disease, quite a sharp case. No previous history of rheumatism in self or family. Throat on admission showed great congestion of faucial region, palate and tonsils, which are enlarged and oedematous. Slight adenitis.

22nd/

22nd day. Arthritis. Dull pain, worse on movement in right wrist, right interphalangeals and right metacarpo-phalangeals. Pain continuous and patient lost power of closing fist. Slight swelling of wrist, pain on pressure over extensor tendons and crepitus on movement of wrist. T. 102.2. P. 130. R. 20.

24th day. Pain, milder than in first attacked joints, in R. shoulder, only on movement. No swelling nor redness. Pain disappeared from right wrist and hand. T. 99. P. 80. R. 18.

26th day. Pain completely disappeared. No further symptoms. Temperature subnormal.

Treatment: Sodium salicylate internally, methyl salicylate soaks to joints. The sodium salicylate exhibited on 24th day.

Note. Arthritis and tenosynovitis. Apparently benefitted by salicylate.

-----

M. P., female, aet. 44.

Admitted Ward III with scarlet fever, in 4th day of disease, a sharp case. No history of previous rheumatism in self or family. Throat on admission showed congestion of fauces and tonsils which were also enlarged and covered with glairy mucus.

No adenitis.

5th day. Arthritis. Pain in both knees, worse in right knee, and in both shoulders. Pain not present except on movement, which was greatly limited. T. 101.2. P. 110. R. 22.

7th day. Pain greatly improved in both knees and left shoulder. Right shoulder still painful on movement. T. 100. P. 92. R. 18.

10th day. Pain away from all joints. Stiffness still in right shoulder. T. subnormal.

12th day. Complete freedom from symptoms to-day.

Treatment: Methyl salicylate soaks to affected joints.

Note. No swelling in any of the joints.

T. T., male, aet. 4.

Admitted Ward VI with scarlet fever in 6th day of disease, a mild case. No previous history of rheumatism in self or family. Throat showed slight congestion of fauces. No adenitis.

6th day. Arthritis. Shortly after admission complained of slight pains in both knees on movement. Pain absent except on movement. No heat, swelling nor redness. T. 99. P. 86. R. 22.

8th day. All symptoms gone. T. subnormal.

Treatment. Methyl salicylate to affected joints.

Note. A very mild arthritis.

10th day. Stiffness in right hand. T. subnormal.

12nd day. No further symptoms.

W. B., female, aet. 30. Methyl

Admitted Ward III with scarlet fever in 4th day of disease, quite a sharp case. A previous history of rheumatism for the last two or three years - subject to occasional joint pains in cold or damp weather. Fever ran the normal course. No complications.

23rd day. Patient had been out in the airing ground during the afternoon. In the evening had pain in left thumb and right metacarpo-phalangeals. Right hand swollen, tender on pressure over the back of the hand, and power less, so that she could not hold a pencil. No redness.

T. 98.8. P. 85. R. 18.

24th day. Pains as above still remained. Pains now felt in left temporo-mandibular joint, left elbow and left shoulder. No swelling nor redness. T. 99.2. P. 100. R. 18.

25th/



25th day. Left thumb and right hand cleared up,  
no pain and swelling gone. No pain in jaw.  
Still pain in elbow and shoulder. Pains in  
both knees and in muscles of lumbar region.

T. 100. P. 98. R. 18.

28th day. All pains gone but have returned to right  
hand, which however is not swollen. T. subnormal.

30th day. Stiffness in right hand. T. subnormal.

32nd day. No further symptoms.

Treatment: Sodium salicylate on 24th day. Methyl  
salicylate soaks to joints.

Note. Previous history of rheumatism and extensive  
involvement of joints. Myositis.

A. R., female, aet. 15.

Admitted Ward III with scarlet fever in 3rd day  
of illness, a sharp case. No previous history of  
rheumatism in self or family. Throat congested,  
tonsils enlarged. No adenitis.

3rd day. Arthritis. Pain in metacarpo-phalangeals  
of right hand. Slight swelling on back of hand,  
pain on pressure over extensor tendons, slight  
heat. No swelling. T. 103. P. 122. R. 18.

5th day. Both shoulders painful to-day. No swelling  
nor/

nor redness. Both wrists also very painful, swollen, hot, and crepitus on movement. Joints of hand still painful also. T. 101.6. P. 100. R. 18.

6th day. Pains completely disappeared during the night. T. subnormal.

7th day. No further involvement.

Treatment: Methyl salicylate soaks.

Note. Sudden clearing up of arthritis. No salicylate given internally.

J. K., male, aet. 10.

Admitted 3rd day of disease to Ward IV, a sharp case. No previous history of rheumatism. Throat greatly congested, tonsils enlarged, nearly meeting in mid line, and show one or two specks of pus. On 4th day adenitis appeared but by 6th day temperature from that subsided.

6th day. Pain in both knees, worse on movement.

Knees hot, and swollen, and kept in a position of flexion. No redness. Later in the day pain appeared in both wrists and shoulders. No swelling or redness in them. T. 101.8. P. 104.

R. 22. Needle introduced into right knee and 0.5 cc. turbid whitish fluid withdrawn. One drop/

drop put on slide for direct examination and two tubes of serum broth inoculated with rest of fluid.

8th day. Pains all cleared up. No further symptoms.

T. subnormal.

Treatment: Methyl salicylate soaks.

Note. Direct film showed many polymorphonuclear leucocytes. No organisms found. Serum broth tubes incubated at 37°C. for one week, one aerobically and one anaerobically. Daily platings made on serum agar. No growth obtained by either method.

A. B., female, aet. 15.

Admitted 4th day of disease, a sharp case. No previous history of rheumatism. Throat shows infection of fauces, tonsils and palate. Slight adenitis.

5th day. Arthritis. Pains in both wrists and in muscles of arm and forearm. No swelling nor redness of wrists. Pain worse on movement, both active and passive, but not sufficient to prevent sleep. Complains of helpless feeling in the arms. T. 102.2. P. 96. R. 20.

8th day. Pain in wrists and arm still present but not/

8th day of relapse. Pains disappeared but still not so acute. Now complains of pain in left shoulder. Heat to touch but no swelling nor

redness. Limitation of movement at that joint.

9th day. Involvement of right shoulder. Pain and stiffness in both shoulders. Still pain in arm muscles. Wrists cleared up. T. 100. P. 85.

R. 18.

12th day. Free from pain and stiffness to-day.

T. subnormal.

Treatment: Methyl salicylate soaks to affected joints.

Note. Myositis.

N.P., female, aet. 11.

Patient admitted to Ward III as an observation case but fifteen days later developed a good scarlet. Was considered a true relapse. No history of previous rheumatism. Throat showed congestion of fauces and palate at the onset of the relapse.

5th day of relapse. Arthritis. Severe pains appeared in right wrist, and right interphalangeal joints. Could not close fingers. Pain kept her from sleeping but no swelling nor redness. Joints hot to touch. T. 100. P. 94.

R. 20.

9th/

9th day of relapse. Pains disappeared but still stiffness. T. subnormal.

10th day of relapse. Complete freedom from symptoms.  
Treatment: Methyl salicylate soaks to affected joints.

Note. Severe pain unaccompanied by swelling.

M. H., female, aet. 12.

Admitted to Ward III with scarlet fever on the 3rd day of disease, a mild case. No previous history of rheumatism in self or family. Throat, on admission, congested but clean.

5th day. Arthritis. Pain in right elbow, only on movement. Joint hot to the touch but no swelling or redness. T. 100. P. 104. R. 20.

6th day. Pain almost disappeared in elbow. Left metacarpo-phalangeals and one or two inter-phalangeals involved. No swelling nor redness. Only a feeling of stiffness on movement.  
T. 99.2. P. 95. R. 20.

8th day. Symptoms completely cleared up.  
T. subnormal.

Treatment: Methyl salicylate soaks to affected joints.

Note. Mild nature of scarlet and mild nature of arthritis.

J. B., male, aet. 6.

Admitted Ward VI, with scarlet fever on 6th day of disease, a sharp case. No previous history of rheumatism. Throat on admission showed congestion of fauces and palate, enlargement of the tonsils with some patching on the right. Course of fever uneventful, no complications and patient allowed up on 21st day and out on the 25th day.

27th day. Arthritis. Pain in both wrists and metacarpo-phalangeal joints. Pain only on movement but patient cannot grip a pencil. No redness nor swelling. No rise of temperature or pulse.

28th day. Pains away from left hand. Still present in right hand.

30th day. No further symptoms.

Treatment: Patient put back to bed for two days and methyl salicylate soaks to affected joints.

Note. A late case.

Mrs P., female, aet. 31.

Admitted to Ward III with scarlet fever in 3rd day of disease. No previous history of rheumatism.

Five/

Five days before admission gave birth to premature twins, both dead; labour easy. Throat on admission showed congestion.

4th day. Arthritis. Complains of continuous pain in both shoulders, worse on movement. Joints hot to the touch. No swelling or redness. Tenderness on palpation. Complains of myositis in calf muscles. T. 102.2. P. 130. R. 28.

5th day. Pain in shoulders much the same but muscular pain in calf disappeared.

9th day. Pain in shoulders almost away but now complains of right elbow. No tenderness, heat, swelling nor redness in this joint. General condition poor and respirations rapid. Pneumonic patches in both lungs. T. 103. P. 146. R. 32. Heart sounds weak but clear and closed.

10th day. No further involvement of joints. Patient excessively weak and died. T. 105.6. P. 146.

R. 44.

Treatment: Methyl salicylate soaks to affected joints. Stimulated for her general condition. Derived benefit from the local application.

Note. Myositis as well as arthritis. Broncho-pneumonia the complication causing death.

C. C., female, aet. 22. sodium salicylate internally

Admitted Ward III with scarlet fever in the 3rd day of disease, a sharp case. History of previous rheumatism since the age of 17. Throat congested but clean. No adenitis.

5th day. Arthritis. Complains of pains in both wrists, elbows and shoulders, only on movement.

Pains in right biceps and muscles of forearms.

6th day. No redness nor swelling of joints. All joints hot to touch. Patient perspiring very freely.

T. 102.6. P. 118. R. 18. brilliant. Throat

8th day. Pains now only present in left shoulder.

Feeling of stiffness in other joints and in

muscles of her arms. Complains of pain in her

left shoulder "catching her breath". Nothing

made out on examination of her lungs. Heart

sounds regular, clear and closed in all areas.

T. subnormal. P. 95. no redness nor swelling

10th day. Pain returned to right shoulder. Pains

still in her left shoulder. Pains seem worse

at night. T. subnormal. P. 95.

11th day. Pain all away except in right shoulder.

T. subnormal. P. 95. much better.

13th day. Completely free from symptoms. Pulse still

between 90 and 100. P. 100. R. 22.

Treatment: /



Treatment: Patient on sodium salicylate internally since joint pains appeared. Methyl salicylate soaks to affected joints.

Note: Previous history of rheumatism. Myositis.

W. S., male, aet. 10.

Admitted Ward IV with scarlet fever in the 2nd day of disease, a sharp case. A "return" case. No arthritis in the infecting case which was quite uncomplicated. Rash exceptionally brilliant. Throat congested but clean. Tongue ulcerated. No adenitis. No history of rheumatism.

5th day. Arthritis. Both wrists painful, and has a helpless feeling on attempting to grasp anything. Pain worse on passive movement. Tenderness on palpation along tendons round wrist joint. Crepitus on movement. No redness nor swelling. Marked heat on palpation. Myositis in quadriceps extensors of both legs. T. 101. P. 116. R. 28.

7th day. Pain disappeared from legs. Wrists still a little painful but much better.

8th day. Pain in both elbows. No swelling nor redness. T. 100.6. P. 100. R. 22.

9th/

9th day. Pain better in wrists but both elbows still painful. Involvement of right knee which is slightly swollen. T. 102. P. 118. R. 22.

10th day. Pain now in left ankle which is slightly swollen. Left knee also painful to-day.

Pain still present in both elbows also.

T. 100. P. 112. R. 22.

11th day. Stomatitis. Improvement in all joints which are much less painful, except both knees.

Swelling away from knee and ankle. T. subnormal.

P. 96. R. 22.

14th day. Complete freedom from symptoms.

T. subnormal. P. 80.

Treatment: Sodium salicylate from 7th day. Methyl-salicylate soaks to joints.

Note. Extensive involvement. Myositis. Apparent ineffectiveness of salicylate internally.

Mrs E. S., female, aet. 43.

Admitted Ward III with scarlet fever, a mild case. Previous history of rheumatism extending over 12 years. Admitted in 6th day of disease. Throat congested mildly and clean.

6th day. Complained of pain in both metacarpophalangeals, both wrists, both elbows, and both/

both shoulders. Swelling of both hands, pain on pressure over extensor tendons of the wrist and crepitus. Joints hot to touch. No redness. T. 100. P. 112. R. 20.

8th day. Swelling completely gone. Still occasional twinges of pain in all above joints.

T. subnormal.

9th day. Condition completely cleared up.

Treatment: Methyl salicylate soaks to affected joints.

Note: History of rheumatism.

Mrs J. C., female, aet. 22.

Admitted Ward III with scarlet fever, a mild case. No previous history of rheumatism but states her father suffered from rheumatism for years. Admitted in 3rd day of disease. Throat on admission showed slight congestion in fauces.

7th day. Arthritis. Patient complained of pain in both wrists and lack of power to hold things. Tenderness, and heat round both joints, pain on passive movement not increased, no swelling nor redness. T. subnormal.

8th day. Pain away from wrists, still a feeling of/

of stiffness. Right knee now painful but shows no swelling nor redness. Slight heat to touch and patient maintains joint in a flexed position and resents passive movement. T. subnormal.

10th day. All symptoms cleared up.

Treatment: Methyl salicylate soaks to joints.

Note. Mildness of initial fever and mildness of arthritis. No rise of temperature.

I. F., female, aet. 22.

Admitted Ward III with scarlet fever in 3rd day of disease, a severe case. No previous history of rheumatism in self or family. Throat on admission showed great congestion of fauces, soft palate, uvula and posterior pharyngeal wall. Tonsils enlarged, oedematous and patched. Symptoms from throat very acute in incubation period. Enlargement and tenderness of glands on both sides of neck.

2nd day. Arthritis. The day before admission patient had joint pains which began in right elbow, then in both ankles and lastly in both knees. Pain mild in the last site but in the elbow and ankles was very acute. Patient states there was no swelling nor redness. She also complained of pain in the biceps muscle.

3rd/

3rd day. Pain now in left shoulder, left elbow, left wrist, left metacarpo-phalangeals and interphalangeals. The pain is now very acute and patient compares it to toothache. Joints hot to touch but no swelling nor redness except in finger joints and wrist. T. 98.8. P. 100. R. 20. Glands in neck still large and painful. Throat still sore.

4th day. Pains practically disappeared but still feels occasional twinges of pain and general stiffness. Swelling and redness of wrist and finger joints gone. T. 99. P. 96. R. 20.

6th day. Had pains in both shoulder joints during the night. T. subnormal.

8th day. No further symptoms of arthritis. T. subnormal.

Treatment: Sodium salicylate from 3rd day, methyl-salicylate soaks to joints. Patient states she felt more comfortable after the salicylate soaks.

Note. Extensive involvement of joints and marked throat condition. Myositis.

J.S., Female, 35.

Admitted with fever in the day of disease, a sharp case. Previous history of rheumatoid

D. G., female, aet. 7.

Admitted Ward IV with scarlet fever in 2nd day, a sharp case. No previous history of rheumatism. Throat showed congestion of fauces and palate, tonsils enlarged. Case ran an uneventful course till 14th day when temperature went up to  $101.4^{\circ}\text{F}$ ., due to adenitis. Temperature fell next morning to  $99^{\circ}\text{F}$ . but rose in the evening to  $100.2^{\circ}\text{F}$ .

16th day. Arthritis. Pain in both wrists, both elbows, both knees, and pain in region of Achilles ligament on right side on dorsiflexion of foot. No swelling nor redness of joints. Slight creaking over Achilles ligament on passive movement. T.  $99.6^{\circ}$ . P. 84. R. 20.

18th day. Pains very much better but still complains of stiffness in affected joints. T. subnormal.

20th day. Symptoms completely disappeared.

Treatment: Sodium salicylate internally on 16th day. Methyl salicylate soaks to affected joints.

Note. Tenosynovitis in unusual situation.

J. S., female, aet. 36.

Admitted Ward III with scarlet fever in 4th day of disease, a sharp case. Previous history of rheumatic/

51.  
 Knees hot to touch; no swelling nor redness.  
 rheumatic pains in wrists in winter. Throat on admission not painful, slightly congested and palate red.

No adenitis. Pain still present. No further involve-

6th day. Arthritis. Pains in both wrists, metacarpophalangeals and interphalangeals of both hands.

Pain only present on movement and on attempting this experiences a feeling of helplessness.

No swelling nor redness of joints. Complains of pain in flexor muscles of forearm.

T. 99.6. P. 96. R. 20.

8th day. Pains all away. Slight feeling of stiffness. T. subnormal. 1st fever in 3rd day.

10th day. Complete freedom from symptoms. self or

Treatment: Sodium salicylate internally on 6th day,

enlarged\* Methyl salicylate to affected joints.

Note. Mild nature of arthritis. red in both wrists,

first noticed when supporting himself in bed.

Joints not hot to touch, no swelling, nor redness.

J. A., male, aet. 3. 2. 25.

Admitted Ward II with scarlet fever in 2nd day of disease, a sharp case. No previous history of rheumatism in self or family. Throat on admission showed slight congestion of fauces, and tonsils, which were slightly enlarged but clean. No adenitis.

7th day. Arthritis. Complains of pain in right knee, worse on passive movement which he resents.

Knee/

Knee hot to touch; no swelling nor redness.

Maintained in a position of flexion and slight outward rotation. T. 100.6. P. 144. R. 28.

10th day. Pain still present. No further involvement. T. subnormal.

11th day. Complete absence of symptoms and function normal. T. subnormal.

Treatment: Methyl salicylate soaks to joint.

Note. Only one joint involved.

C. K., male, aet. 12.

Admitted Ward II with scarlet fever in 3rd day, a sharp case. No history of rheumatism in self or family. On admission throat congested and tonsils enlarged.

7th day. Arthritis. Pain appeared in both wrists, first noticed when supporting himself in bed. Joints not hot to touch, no swelling, nor redness. T. 100. P. 120. R. 26.

8th day. Pain practically gone. T. subnormal.

11th day. Pain in left elbow, not severe in character, only present on movement. No swelling nor redness. Pains in wrists completely cleared up.

T. 99. P. 86. R. 20.

13th/





13th day. Complete absence of symptoms. T. sub-normal.

Treatment: Methyl salicylate to affected joints.

Note. Condition practically cleared up when another joint involved.

A. H., female, aet. 8.

Admitted to hospital as a case of diphtheria and received 8000 units of antitoxin. The diagnosis was confirmed by bacteriological examination and the succeeding course of the disease was uneventful till on the 12th day after admission patient developed a good scarlet rash. Patient then transferred to Ward VI and was a sharp case. On admission to the scarlet fever ward throat was red and congested. No previous history of rheumatism.

7th day. Arthritis. Patient complained of pains in right elbow and wrist, worse on movement. No swelling nor redness. Feeling of heat in wrist and tenderness on pressure over the tendons round the wrist, together with crepitus.

T. 102.2. P. 136. R. 26.

8th day. Pain still the same in above joints and left elbow and wrist now affected. Wrists held in/

in a position of extension and elbows flexed.

T. 101. P. 130. R. 24.

10th day. Pain a little better in other joints.

Involvement of right knee, which is slightly swollen, tender on pressure over tendons, and kept flexed. Pain worse on movement and no crepitus evolved. T. subnormal.

13th day. Only stiffness in other joints. Pain now complained of in right ankle. T. 99.6.

P. 100. R. 24.

16th day. Symptoms quite disappeared. T. subnormal.

Treatment: Methyl salicylate to affected joints.

Note. Previous administration of serum.

Nurse McM., female, aet. 18.

Admitted Ward III with scarlet fever in 3rd day of disease, a sharp case. No previous history of rheumatism. Throat showed fauces and tonsils congested but clean. Case ran an uneventful course until 38th day when patient developed adenitis. She was discharged on the 44th day and went on duty on the 47th day.

48th day. Readmitted Ward III complaining of pains in both wrists and ankles, continuous in character, not very acute, but worse on movement. Swelling in both wrists which are extended/

extended slightly; no redness. Ankles not swollen but tender on pressure over tendon sheaths. T. subnormal.

51st day. Pain and swelling cleared up but still complains of stiffness. T. subnormal.

53rd day. Complete freedom from symptoms.

Treatment: Sodium salicylate internally from first day of arthritis. Methyl salicylate soaks to affected joints.

Note. The appearance of arthritis.

E. M., female, aet. 7.

Patient admitted in the first instance with diphtheria, confirmed bacteriologically. Received 4000 units of antitoxin and course uneventful. On 27th day after admission developed scarlet fever, a sharp case, and transferred to Ward IV. No previous history of rheumatism. Throat deeply infected, slight enlargement of tonsils. Adenitis appeared in 2nd day of scarlet, marked on both sides of the neck.

3rd day. Arthritis. Patient complains of pain in both knees, worse on movement. There is slight swelling and knee kept flexed. No tenderness nor redness. T. 101.4. P. 136. R.24.

4th/

4th day. Both ankles involved as well as above joints, toes of left foot and right wrist.

No swelling nor redness. Glands in neck still large. T. 102.8. P. 146. R. 24.

5th day. Pain, swelling and heat in left wrist, left metacarpo-phalangeals and interphalangeals. Back of hand puffy but does not pit on pressure. Right wrist almost better but knees still troublesome. T. 100.4. P. 130. R. 24.

11th day. First day that pain has been absent. Pain has not been continuous but one or other of the joints has been intermittently painful. T. 100.4. P. 102. R. 26. Child still poisoned looking and lethargic. Adenitis still troublesome.

12th day. T. subnormal.

Treatment: Sodium salicylate internally on 4th day of illness. Methyl salicylate to affected joints.

Note. Administration of serum, extensive involvement, including toes.

I. P., female, aet. 12.

Admitted Ward III with scarlet fever in 2nd day of disease, a sharp case. No previous history of rheumatism/

rheumatism in self or family. Throat on admission showed congestion, some glairy mucus on tonsils, palate red. Rhinitis on admission and on 4th day developed adenitis.

8th day. Temperature rose to 100.2°F.

10th day. Arthritis. Finger joints of both hands painful, swollen and flexed. Slight redness in a few. T. 101. P. 98. R. 22.

12th day. Both elbows now painful as well. Swelling still present in fingers.

13th day. Slight occasional pains in both knees and ankles which show no swelling, redness nor heat to touch. T. 99. P. 100. R. 24.

16th day. Pains cleared up except for right ankle in which the pain is sometimes very severe and which was the seat of an injury a year or two previously. T. subnormal.

19th day. Complete absence of symptoms. Temperature has remained subnormal.

Treatment: Methyl salicylate to affected joints.

Note. Severe pain in ankle previously injured.

D. M., male, aet. 10.

Admitted Ward VII with scarlet fever in 4th day of disease, a sharp case. No previous history of/

of rheumatism. Throat on admission red and congested; tonsils slightly enlarged. No adenitis. Temperature never settled after admission.

8th day. Arthritis. Patient first complained of pains in the palms of both hands, and later in both wrists and fingers of both hands. Slight swelling on back of right hand; no pitting on pressure; wrists maintained in a position of flexion. T. 100. P. 140. R. 28.

10th day. Pains still present. T. subnormal.

12th day. Both knees affected with pain, dull in character, continuous, and worse on movement. No swelling nor redness. Joints hot to touch. Still pains in other joints.

14th day. Complete absence of symptoms. Temperature has been subnormal since 10th day.

Treatment: Methyl salicylate to affected joints.

Note. Temperature remained subnormal in spite of involvement of fresh joints.

W. R., male, aet. 10.

Admitted Ward VII with scarlet fever in 6th day of the disease, apparently a mild case. No previous history of rheumatism. Throat on admission had cleared up and there was nothing abnormal to note. Case progressed/

progressed satisfactorily without complication.

25th day. Arthritis. Patient complained of pains in finger joints of both hands. No swelling, no redness, no heat to touch. No rise of temperature.

26th day. Now complains of pain in both wrists and both shoulders, and still in finger joints originally attacked, although these are a little better. No swelling of wrists or shoulders. Slight crepitus on moving the wrists.

T. 99.6. P. 128. R. 24.

27th day. Pain still in shoulders and fingers again acutely painful. No swelling in finger joints which are kept flexed and patient resents their extension. T. 100. P. 112. R. 26.

31st day. Complete freedom from symptoms. Temperature subnormal since 28th day. Patient kept in hospital owing to development of a running nose but since a day or two after the clearing up of his arthritis has been up and out in the airing grounds.

55th day. Patient complained of pain in upper cervical region posteriorly and also in right shoulder. Tenderness on palpation over right trapezius and has pain increased on shrugging the right shoulder. T. 99.8. P. 120. R. 24.

59th/

59th day. Pain much better. T. subnormal.

60th day. Complete freedom from symptoms again.

Treatment: Methyl salicylate soaks to affected joints.

Note. Relapse in finger joints. Pain first sign of arthritis. Occurrence of myositis twenty-four days after arthritis cleared up.

J. B., female, aet. 8.

Admitted Ward IV with scarlet fever in 3rd day of disease, a sharp case. No previous history of rheumatism. Throat on admission was congested and tonsils enlarged and oedematous. Slight adenitis. Case ran an uneventful course till the 25th day when adenitis appeared. After that time temperature never quite settled.

31st day. Arthritis. Pain in both wrists and both knees. No swelling, nor redness. Joints hot to touch and faint creaking elicited in both wrists and knees. Wrists flexed and knees flexed. T. 99.2. P. 116. R. 24.

32nd day. Pains as before but T. subnormal.

33rd day. Pain in right elbow and shoulder, in addition to joints first affected. Nothing to be made out on physical examination of these/



very these joints. In the evening of this day the temperature fell but left hip now involved and pain very severe so that child required Dover's powder.

35th day. Joints much better. Temperature remains subnormal.

36th day. Albuminuria. P. 108. R. 83.

39th day. Exacerbation of pain in left wrist and left metacarpo-phalangeals, also inter-phalangeals of left hand. Swelling of back of hand, tenderness on pressure, but no pitting. Joints hot to touch. Pain much worse on movement. Still complains of pain in left knee which has never been quite free from pain. No rise of temperature with this exacerbation.

41st day. All signs and symptoms of arthritis gone.

Treatment: Methyl salicylate soaks to joints.

Note. Association of albuminuria with exacerbation.

Mrs J. S., female, aet. 30. history of rheumatism

Admitted Ward III with scarlet fever in 5th day of disease, a severe case. Gives a history of an attack of acute rheumatism 15 years ago following a quinsy. Has not suffered since and as far as she knows has had no heart symptoms. On admission throat very/

very infected, a lot of glairy mucus covering tonsils and posterior pharyngeal wall. Tonsils enlarged and inflamed. Adenitis in glands of both sides of neck.

7th day. Arthritis. Complains of a dull ache and swelling of finger joints of both hands. Joints hot to touch but no redness. Fingers kept flexed. T. 101.2. P. 108. R. 22.

11th day. Pains away, only a little stiffness left. T. now subnormal, having come down in a straight line from its original uprise.

13th day. Complete absence of symptoms and signs.

Treatment: Sodium salicylate internally on 8th day of illness. Methyl salicylate soaks to joints.

Note. Mild arthritis following a severe scarlet.

History of previous rheumatism.

Mrs M. W., female, aet. 21.

Admitted Ward III with 'scarlet' fever in 4th day of disease, a mild case. No history of rheumatism but reports an attack of neuritis three months ago in her left arm. Throat slightly congested, palate red. Slight adenitis on both sides of neck.

5th day. Arthritis. Complains of pains in both wrists and pain and swelling of both hands.

Finger/

Finger joints swollen and stiff but patient says they are not painful, either on active or passive movement. Towards evening noticed pain in shoulders on turning in bed. In addition myositis in muscles of arm and forearm and in front of both legs. T. 101.8. P. 132. R. 26.

8th day. Patient cleared up except for slight pain still in right shoulder. T. 100.1. P. 132. R. 26.

10th day. Pains all away. T. subnormal.

11th day. Short attack of severe pain in metacarpophalangeal joint of right thumb. T. subnormal.

13th day. Complete freedom from symptoms.

Treatment: Sodium salicylate internally. Methyl salicylate soaks to joints. Patient states she felt comforted by the local application.

Note. Temperature came down in an even line from the onset. Myositis.

Mrs G., female, aet. 29.

Admitted Ward III with scarlet fever in 4th day of disease, a sharp case. No previous history of rheumatism. Throat on admission showed congestion of/

of fauces, tonsils enlarged, some specks on left tonsil. Slight adenitis.

17th day. Arthritis. Pain in right shoulder and elbow joints. Swelling of right wrist and back of hand but no pain on passive movement of these joints. Myositis in biceps and forearm muscles. No rise of temperature. P. 84.

R. 22.

18th day. Pain disappeared except from right elbow.

T. subnormal. P. 84. R. 22.

19th day. Pain still in right elbow, increased when arm gets heated up under the blankets.

T. subnormal. P. 16. R. 22.

23rd day. Pains disappeared except for slight recurrence in right shoulder on getting warmed up in bed the previous night. Also transient swelling and pain in right hand in the early part of the day. T. subnormal. P. 96. R. 20.

24th day. Complete freedom from symptoms.

Treatment: Sodium salicylate internally on 18th day.

Methyl salicylate soaks to affected joints.

Note. Absence of temperature reaction. Myositis.

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M. G., female, aet. 27.

Admitted Ward III with scarlet fever in 4th day of disease, a sharp case. No previous history of rheumatism. Throat on admission showed congestion of fauces; tonsils enlarged, inflamed and patched. Posterior pharyngeal wall deeply infected and covered with mucus. Adenitis on left side of neck. No complication till 14th day when otorrhoea appeared. Rhinitis on 31st day. Mastoiditis on 34th day. Operation on 36th day.

40th day. Arthritis. Pains in both elbows and both wrists, most marked in right elbow and wrist. No swelling and no pain or stiffness except on movement. T. subnormal.

42nd day. Pains much better but still present.

No involvement of other joints.

44th day. Slight pain in left wrist and elbow.

Other joints completely cleared up.

46th day. Arthritis completely cleared up but patient's general condition still poor.

Treatment: Methyl salicylate to affected joints.

Note. Incidence of operation just before arthritis.

Late appearance of arthritis.

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M. I., female, aet. 10.

Admitted Ward VII with a history of vomiting and diarrhoea, sore throat, and rash a fortnight previously. Now desquamating. No history of rheumatism. Case ran an uneventful course and desquamated as a true scarlet. Slight flicker of temperature on the 26th and later on the 30th day. On 35th day temperature rose to 99.8°F. and remained in that region till 38th day when the first symptoms of joint involvement appeared.

38th day. Arthritis. Pain in both ankles and both knees. Joints hot to touch and some creaking on active movement at ankle. Ankles extended, knees bent. No swelling nor redness.

T. 100. P. 115. R. 26.

39th day. Symptoms quite gone. Submits to movement both active and passive. T. 98.4. P. 104.  
R. 26.

Treatment: Methyl salicylate soaks to affected joints.

Note. Rise of temperature before arthritis declared itself.

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H. K., female, aet. 9.

Admitted Ward VII with scarlet fever in the 2nd day of disease, a mild case. No previous history of rheumatism. Throat on admission showed slight congestion, slight enlargement of tonsils which were clean. Case ran an uneventful course till the 25th day.

25th day. Arthritis. Complains of pain in left elbow and fingers of both hands. The pain is worse on movement and there is swelling of the interphalangeal joints of right hand. Joints feel hot to the touch. Elbow shows no swelling, no redness; slight tenderness on palpation. Nothing to be made out in left hand.

T. 99. P. 106. R. 24.

27th day. No further involvement of joints and pain very slight now. T. 100.4. P. 112. R. 24.

28th day. Pains completely gone. No symptoms whatever. T. subnormal.

Treatment. Aspirin internally on 26th day and Methyl salicylate soaks to joints.

Note. Late incidence of the complication. Some benefit apparently from aspirin.

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M. N., female, aet. 23.

Admitted to Ward III with scarlet fever in 3rd day of disease, a severe case. No previous history of rheumatism in self or family. Throat very painful and patient had great difficulty in swallowing even fluids. Intense congestion of palate, uvula, posterior pharyngeal wall and fauces. Tonsils enlarged, inflamed, and show patches of greyish slough. Temperature high on admission -  $104.4^{\circ}\text{F}$ . - but fell to  $99.8^{\circ}\text{F}$ . on morning of 6th day.

6th day. Arthritis. In evening severe pain appeared in both wrists, succeeded by a dull ache which is continuous. Fingers of both hands a little stiff, no pain but could not grip anything with them. Wrists swollen, tender on palpation, and pain over tendon sheaths. Pain worse on active movement, passive movement makes little difference. Pain also in neck and patient localised it to the sterno-mastoid and adopted the attitude of wry neck. T. 101.4. P. 130.

R. 26.

7th day. Pain easier but still present in all sites.

T. 100. P. 120. R. 26.

8th day. Pain has cleared up except in wrists which are/



are still slightly sore on movement. T. 100.

P. 112. R. 26.

9th day. Complete absence of symptoms. T. subnormal.

Treatment: Sodium salicylate internally; Methyl-salicylate to joints.

Note. Severe case with comparatively limited arthritis. Myositis.

S. M., female, aet. 7.

Admitted to Ward VI with scarlet fever in 3rd day of disease, a severe case. History not available. Throat infected, tonsils enlarged and glairy, palate deeply congested. Slight adenitis on both sides.

6th day. Arthritis. Pain in both wrists. No swelling and no tenderness on palpation over tendon sheaths. Wrists kept extended slightly.

T. 101.6. P. 120. R. 24.

9th day. Rhinitis.

10th day. Pains in wrists still persisting. Now complains of pain and swelling in right ankle which is kept extended. Movement resisted. Joint feels hot. Otitis in left ear.

T. 103. P. 148. R. 32.

11th day. Left ankle now involved. Pain, worse on/

on movement, no swelling nor redness.

Tenderness on pressure over tendon sheaths,  
no pitting.

13th day. Stiffness in affected joints.

T. subnormal.

14th day. No further symptoms. T. 99.6. P. 100.

R. 26.

16th day. Temperature subnormal.

Treatment: Methyl salicylate soaks to affected  
joints.

Note. Rhinitis and otitis appeared after arthritis  
had definitely declared itself.

D. H., male, aet. 8.

Admitted Ward IV with scarlet fever in 2nd day  
of disease, a sharp case. No previous history of  
rheumatism. Throat congested and cervical glands  
slightly enlarged and tender. On 3rd day lobar  
pneumonia appeared in right lung. Temperature  
remained up, average 102 from admission onwards.

11th day. Arthritis. Slight pain in left wrist.

No swelling nor redness. Joint not hot to  
the touch. T. 101.6. P. 124. R. 28.

12th day. Pain in left elbow. No physical signs  
to be made out.

15th/

15th day. Abscess appeared on dorsal aspect of left wrist. T. subnormal.

17th day. Temperature 102. No further symptoms of arthritis.

21st day. Abscess incised. Temperature subnormal and has remained so. Abscess was in skin and when opened was not communicating with joint.

Treatment: Methyl salicylate to joints until

abscess in wrist.

Note. Coincidence that abscess appeared above wrist. Had no connection with the arthritis.

M. K., female, aet. 13.

Admitted Ward III with scarlet fever in 3rd day, a sharp case. No history of rheumatism. Throat red and congested. Palate infected. No initial adenitis.

7th day. Arthritis in right wrist. Pain slight when joint at rest; no signs of inflammation except pain. T. 101. P. 96. R. 22.

10th day. Pain disappeared but temperature still up.

11th day. Otorrhoea commenced, possibly accounting for temperature being still up.

Treatment: Methyl salicylate soak to joint.

Note. Mild nature of arthritis.

Treatment: Methyl salicylate to affected joints.

Note. Patient states that shoulders were most painful of all joints affected.

M.M., female, aet. 20.

Admitted to Ward III with scarlet fever in 3rd day of disease. No history of rheumatism in self or family. A sharp case. Throat red and congested. Mucus on both tonsils. Palate infected. Slight adenitis in cervical glands.

5th day. Arthritis in both wrists which are painful.

No swelling nor redness. Joints hot to touch.

No tenderness on palpation and pain worse on passive movement. Myositis in both sternomastoids. T. 102. P. 112. R. 26.

7th day. Complains of dull pain in both shoulders.

Wrists as before. Temperature remains between 100 and 101.

9th day. Knees affected. Stiffness and pain on movement. Knees flexed and are not painful when at rest. Pain still present in left shoulder. Now absent from wrists and right shoulder.

T. 100. P. 96. R. 24.

11th day. Left shoulder still painful. T. 99.

P. 90. R. 22.

18th day. Still stiffness in left shoulder, especially in the morning. Temperature has averaged 99°F. for the last week.

20th day. All symptoms disappeared. T. subnormal.

Treatment: Methyl salicylate to affected joints.

Note. Patient states that shoulders were most painful of all joints affected.

M. B., female, aet. 24.

Admitted to Ward III with scarlet fever in 3rd day of disease, a sharp case. No history of rheumatism in self or family. Throat red and congested. Mucus on tonsils and posterior wall of pharynx. Slight enlargement and tenderness of cervical glands. States that pain in throat was severe.

6th day. Arthritis. First symptom to appear was swelling of interphalangeals of third and fourth fingers of left hand. Then pain began in both elbows, both wrists and a few fingers. Pain described as gnawing in character, worst in the elbows. No swelling of wrists. T. 99. P. 108. R. 26.

8th day. Pain very much better. No involvement of both joints. T. 98. P. 80. R. 24.

10th day. Complete absence of symptoms.

Treatment. Methyl salicylate to affected joints.

Note. Appearance of swelling before pain.

Nurse K., female, aet. 18.

Admitted to Ward IV with scarlet fever in 2nd day, a sharp case. No history of rheumatism in self or family. Throat slightly congested with some speckling on tonsils. Pain in throat slight. Case ran uneventful course.

16th/

16th day. Arthritis. Developed pain in left wrist; no redness, swelling, nor tenderness. Pain mild in character and only present on movement.

T. subnormal.

19th day. Pain in right knee. No swelling.

T. subnormal.

21st day. Symptoms cleared up.

Treatment: Methyl salicylate soaks to affected joints.

Note. Complete absence of temperature reaction.

Nurse C., female, aet. 21.

Admitted to Ward IV with scarlet fever in 3rd day, a mild case. No history of rheumatism in self or family. Slight congestion of throat.

6th day. Arthritis. Pain in both wrists, not acute in character, chiefly on movement. No swelling, tenderness, redness, nor heat to touch.

T. 98. P. 104. R. 22.

7th day. Joints as before. T. 97.8. P. 104. R. 22.

9th day. Pain in left shoulder, worse than it was in wrists, but not so bad as to prevent sleep.

T. 97. P. 100. R. 22.

10th day. Complete disappearance of symptoms.

Treatment: Methyl salicylate rubbed over affected joints.

Note. Absence of temperature reaction.

Mrs M. D., female, aet. 23.

Admitted to Ward III with scarlet fever in 6th day of disease, a sharp case. No previous history of rheumatism in self or family. Throat painful and congested. Could not swallow very well. No adenitis.

8th day. Arthritis. Pain in both shoulders only present on movement. No physical signs to be made out. Also pain in biceps muscle of right arm, worse when that muscle was contracted.

T. 101. P. 100. R. 24.

11th day. Pain completely cleared up. T. 99. P. 80.

R. 22.

13th day. Temperature subnormal.

Treatment: Methyl salicylate soaks to joints and rubbed on muscles of arm.

Note. Subsidence of symptoms before temperature fell.

J. W., female, aet. 5.

Admitted to Ward VI with scarlet fever in 4th day of disease, a sharp case. No history of rheumatism in self or family. Throat congested; tonsils enlarged but clean. Palate infected. Slight adenitis on left side. Purulent discharge from nose on admission.

7th day. Arthritis. Both wrists very painful, no swelling nor tenderness. T. 101. P. 140. R. 24.

8th/

8th day. Temperature subnormal.

10th day. Metacarpo-phalangeal joints of both hands painful, marked swelling over back of hand, tenderness on pressure, no pitting, no redness. Interphalangeals also sore but no physical signs.

T. 101. P. 116. R. 24.

12th day. No further involvement. Fingers cleared up. Still pain on movement of both wrists, most marked on left. T. 99. P. 104. R. 28.

14th day. Complete absence of symptoms. Temperature subnormal.

Treatment: Methyl salicylate soaks to joints and sodium salicylate on 7th day.

H. D., female, aet. 9.

Admitted to Ward III with scarlet fever in 2nd day of disease, a sharp case. No history of rheumatism in self or family. Throat congested; tonsils swollen and covered with glairy purulent material. Adenitis on 6th day.

11th day. Arthritis. Pain in right arm only produced on pronation, thus localising the inflammatory reaction to the proximal radio-ulnar joint. No physical sign. Pain also at back of knees on movement. T. 102. P. 120.

R. 24.

12th/



12th day. Pain in right wrist only on active and not on passive movement. Pain now much worse in knees which are not swollen but are tender on pressure. T. 102. P. 122. R. 32.

13th day. Stiffness still present. T. subnormal.

14th day. Pains cleared up. T. subnormal.

Treatment: Methyl salicylate soaks to affected joints.

Note. Limitation of pain to one movement, thus enabling joint affected to be ascertained with accuracy.

J. F., male, aet. 27.

Admitted to Ward II as scarlet fever in 3rd day of disease, a severe case. No previous history of rheumatism. Throat and palate very congested; septic membrane on left tonsil stretching up on to soft palate. No adenitis.

4th day. Arthritis. Pain and stiffness in both shoulders with marked impairment of movement on the left side. No swelling nor redness.

T. 99. P. 100. R. 20.

5th day. Pain much easier. T. subnormal.

9th day. Pain now only remains in left shoulder, in which movement is still very limited.

T. subnormal.

13th/

13th day. Complete absence of symptoms.

Treatment: Methyl salicylate soaks to affected joints.

Note. Limitation of movement marked.

M. G., female, aet. 12.

Admitted to Ward III, said to be in her 5th day of scarlet fever. Nothing to be made out on examination in hospital to support the diagnosis. on 5th day after admission developed scarlet fever, a sharp case. No history of rheumatism in self or family. On this occasion throat congested and tonsils enlarged.

5th day. Arthritis. Pain in both knees, not very acute in character. No swelling nor redness.

T. 102. P. 130. R. 26.

6th day. Pain and slight swelling now present in both wrists, metacarpo-phalangeal joints and left elbow. Pain very acute in wrist.

T. 100. P. 130. R. 26.

7th day. Pain now present in left shoulder.

T. 101. P. 132. R. 26.

9th day. No further involvement of joints. Pain away from shoulder but still present in wrists, knees/

knees and elbows, but easier than at first.

Pericarditis and mitral endocarditis diagnosed.

T. 103. P. 140. R. 28.

12th day. Pain continues intermittently in the joints previously affected. Temperature swinging between 101 and 104, usually with a remission of about  $2^{\circ}$  in the morning; pulse between 130 and 140. Soft blowing mitral systolic murmur and pericardial friction over 3rd right intercostal space. Accentuated 2nd pulmonary sound.

16th day. Joint and general condition as before.

Now complains of muscular pain in posterior cervical region and in lumbar region.

20th day. Joint and general condition as before.

Pulse rate showing signs of coming down and is now occasionally 120. Temperature down to 98 for first time. Pericardial friction now heard along left border of sternum.

28th day. Patient looks very ill. Pulsation at root of neck. Temperature swinging between  $99^{\circ}\text{F.}$  and  $102^{\circ}\text{F.}$  with definite remissions each morning. Pulse running about 136. Joint pains away.

35th day. Patient now very exhausted, thin and pallid. No return of joint pain. Temperature and pulse as before.

42nd/

42nd day. General condition gradually getting worse. Exhaustion very marked. No physical signs now of pericarditis as far as can be ascertained. Heart sounds very weak but mitral murmur still audible. Compensation failing.

48th day. Patient complaining of acute pain in left arm. No precordial pain. Heart sounds irregular in time and quality, at times quite indistinguishable one from the other. Pulse almost imperceptible.

49th day. Pain in left arm very troublesome the whole night and became accompanied by precordial pain. Breathing very shallow and rapid. Pulse imperceptible. Death.

Treatment: Methyl salicylate soaks to affected joints and heavy doses of salicylates from the onset. Later stimulants and symptomatic treatment.

Note. Arthritis quite average in its intensity, endocarditis, pericarditis and terminal anginous attack.

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**PART II - STATISTICAL.**

		5.15	27.43
		8.85	19.71
		7.50	16.71
		11.84	9.89
		4.08	1.80
		15.25	.85
		5.75	

TABLE VI.

## MALES. AGE AND SEX INCIDENCE.

Arthritis per cent each year	4.29	2.17	2.11	2.17	2.18	2.00	1.53	1.72	3.04	3.59	1.41	2.74	3.81	3.59	2.97	3.02	3.39		Percentage Case Incidence of A. at Age Periods.	Age Period Percentage of all Arthritis.
Year	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	Total at age period.		
Under 1 yr.	1	1	6	6	5	8	3	2	7	8	11	2	4	4	9	4	4	85	-	-
1 - 2	10	9	13	20	19	18	15	14	26	24	23	27	27	15	21	21	36	338	-	-
2 - 3	21 1	26	30	43	31	37	20	27	38 1	48	43	34	36	22 1	25	33	40 1	554 4	.71	1.33
3 - 4	33	40	42 1	69	49	51	41	29 1	53	60	52	69	36 1	35	54	40	53 1	806 4	.49	1.33
4 - 5	41 2	46	48 1	64	65 1	51	48	31	49	79 1	67	50	30	31	59 1	58	44	861 6	.69	2.00
5 - 10	151 7	188 4	209 4	381 9	277 7	304 7	193 3	175 1	298 9	390 6	298 2	280 6	179 9	209 6	330 9	232 4	377 5	4431 98	2.16	32.78
10 - 15	57 1	41 1	77 2	159 4	109 3	104 3	76 2	73 2	114 5	233 5	148 6	120 5	74 3	146 5	148 2	109 8	192 7	1980 64	3.13	21.40
15 - 20	17	30 2	13	57 3	42 3	34 2	28	31 3	49 2	104 8	92 1	50 5	36 4	54 3	66 5	34 3	66 3	803 47	5.53	15.71
20 - 30	21 3	17 2	16 1	38 2	17	20 1	11 1	13	45 4	74 12	74 2	27	24	34 5	55 6	35 1	70 7	589 47	7.39	15.71
30 - 40	5 2	6	5 1	15 1	7	6	7 1	5	14	20 7	18 1	11 3	8 1	5	12 1	7 1	26 5	177 24	11.94	8.02
40 - 50	-	-	3	2	5	2	5	-	7	6	9	2	-	8 1	4	4 1	10 1	67 3	4.28	1.00
50 and over.	-	-	-	-	-	-	2	-	1 1	1	3	1	-	-	1	+	4 1	13 2	13.33	.66
Total for each year.	357 16	404 9	462 10	854 19	626 14	635 13	449 7	400 7	701 22	1047 39	838 12	673 19	454 18	563 21	784 24	577 18	882 31	10706 299	2.71	

TABLE VII.

## FEMALES. AGE AND SEX INCIDENCE.

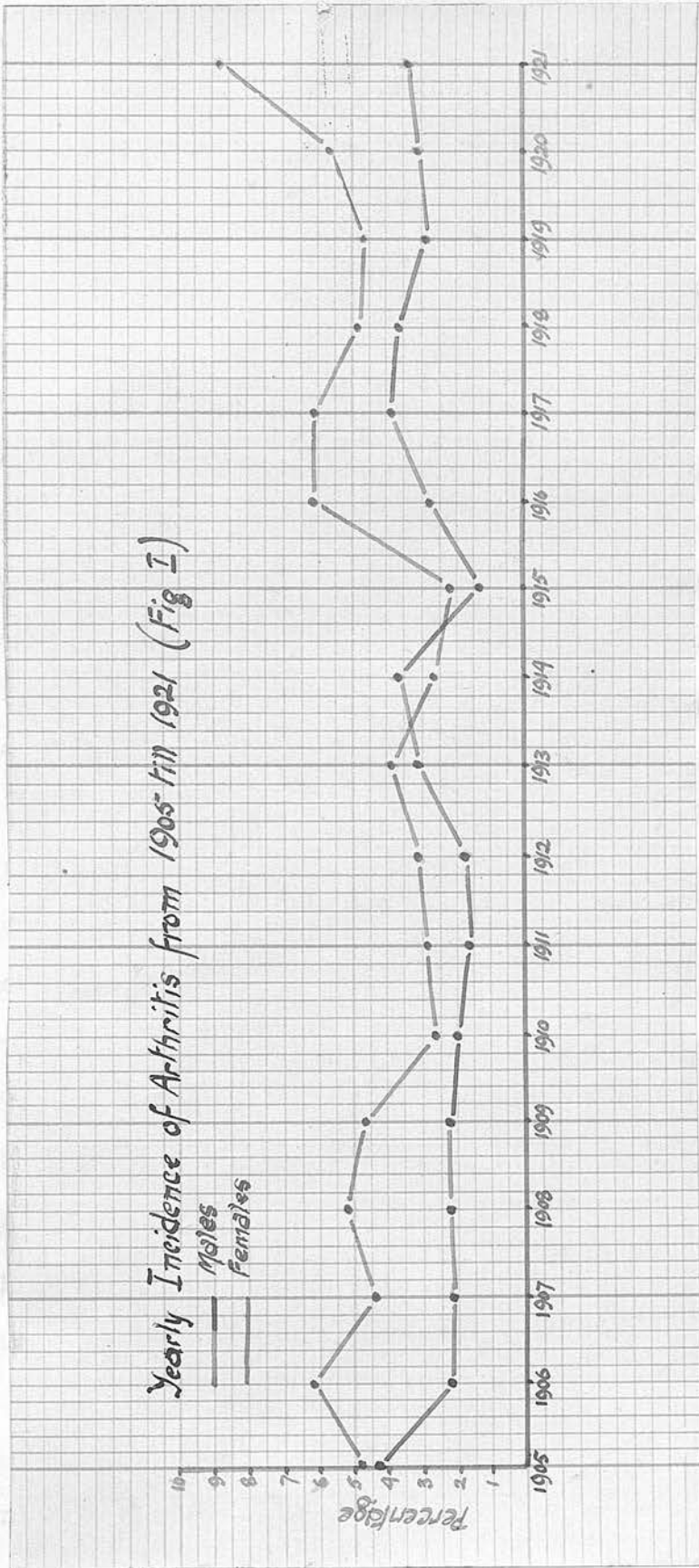
Arthritis per cent each year	4.96	6.22	4.47	5.20	4.57	2.52	2.82	3.01	3.89	2.67	2.08	6.15	6.03	4.84	4.53	5.56	8.63	Total at age period	Percentage Case Incidence of A. at Age Periods.	Age Period Percentage of all Arthritis.
Year	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921			
Under 1 year	1	-	7	3	4	5	6	3	4	6	8	-	17	2	-	5	6	77	-	-
1 - 2	10	15	15	21	21	11	17	6	16	23	11	2	22	13	15	21	38	277	-	-
2 - 3	16	34 1	18	54	29	47	27	14	43	35	48	3	39	27	30	26	42	532 1	.18	.16
3 - 4	33	24 1	47	76	57 2	58 1	30	39	63 2	55 1	45	5	32	45	56 4	46	73 1	784 12	1.50	1.98
4 - 5	36 1	43 1	52	68 1	63 1	55	39	29	53	92 2	60	26 2	53	57 1	61 2	85 2	49	921 13	1.39	2.14
5 - 10	179 12	182 8	266 7	419 13	303 12	318 6	215 4	172 5	341 8	441 7	317 6	310 12	175 12	263 5	374 9	311 8	386 23	4972 157	3.06	25.90
10 - 15	63 4	58 2	94 6	195 9	149 4	135 5	98 6	93 3	159 4	256 5	188 3	177 8	84 4	126 9	220 7	139 7	242 24	2476 110	4.25	18.15
15 - 20	16 1	19 4	28 7	59 10	51 3	40 3	32 2	21	75 7	92 4	82 3	78 6	61 2	65 7	73 5	76 12	92 22	960 98	9.28	16.17
20 - 30	24 1	40 9	33 3	53 15	51 11	45 3	37 3	33 4	96 11	94 11	92 6	58 13	37 9	46 8	68 12	64 13	103 16	974 148	13.19	24.42
30 - 40	3	6 2	14 3	11 4	18 2	18 1	10	8 1	27 4	19 1	29 1	21 3	19 7	18 3	20 5	19 5	54 13	314 55	14.9	9.07
40 - 50	2 1	1	3 1	5 1	6 1	2	4	1	9	12	10	5	4	5	7	4	11 4	91 11	10.78	1.81
50 and over.	-	-	-	1	-	-	1	-	3	5	1	1	2	1	2	1	5 1	23 1	4.17	.16
Total for each year	383 20	422 28	577 27	965 53	752 36	734 19	516 15	419 13	889 36	1130 31	891 19	686 45	545 35	668 34	926 44	797 47	1101 104	12401 606	4.65	

AGE AND SEX INCIDENCE OF SCARLATINAL ARTHRITIS.

Sex Incidence. From a study of the figures relating to the incidence of arthritis in all the cases of true scarlet fever admitted to the City Hospital, Edinburgh, from the beginning of 1905 till the end of 1921 (Tables VI and VII) the incidence works out at 3.76 per cent, 24,012 cases showing arthritis as a complication 905 times. It has long been observed however that arthritis occurs more frequently in the female than in the male and during the above period out of 11,005 cases of scarlet in males, 299 of them developed this complication, whereas in 13,007 cases in females 606 showed it, the percentages working out at 2.71 and 4.65 respectively.

This incidence fluctuates from year to year, the lowest recorded being in 1915 when only 1.41 per cent of males developed arthritis while the highest incidence occurred in 1905 when 4.29 per cent of male scarlet cases showed this complication. The lowest figure for the females was also in 1915, 2.08 per cent being recorded, the maximum incidence in this sex occurring in 1921 when the very high percentage of 8.63 was reached. A consideration of the curves of the yearly incidence (See Fig.I) brings out very clearly/





clearly the above facts and at the same time the interesting observation can be made that there is a fairly definite correspondence in the rising and falling of the two curves. Only on one occasion, in 1914, has the female yearly incidence fallen below the male, and in that year there was an exceptionally large number of cases of scarlet fever admitted to hospital, 1047 males and 1130 females, in fact the highest number of cases admitted in one year during the whole period under review. No statistical nor epidemiological explanation of this is forthcoming. At the first glance it was thought that possibly an epidemic had overtaken some body of newly mobilised troops in the neighbourhood. This would mean that a larger proportion than usual of the cases would fall into the more susceptible age groups (See under Age Incidence) but a study of the Public Health Report<sup>13</sup> for that year referring to Scarlet Fever and Diphtheria informs us that "nothing in the nature of a serious outbreak of these diseases occurred" among the troops, nor does an Analysis of the cases falling about military age, say from 18 to 40, reveal that a greater percentage than usual of males at that age was admitted. In 1914 this percentage was 13.9, while in 1913 and 1915 it was 11.9 and 16.4 respectively and in these two years the curves present their normal relationships.

As/

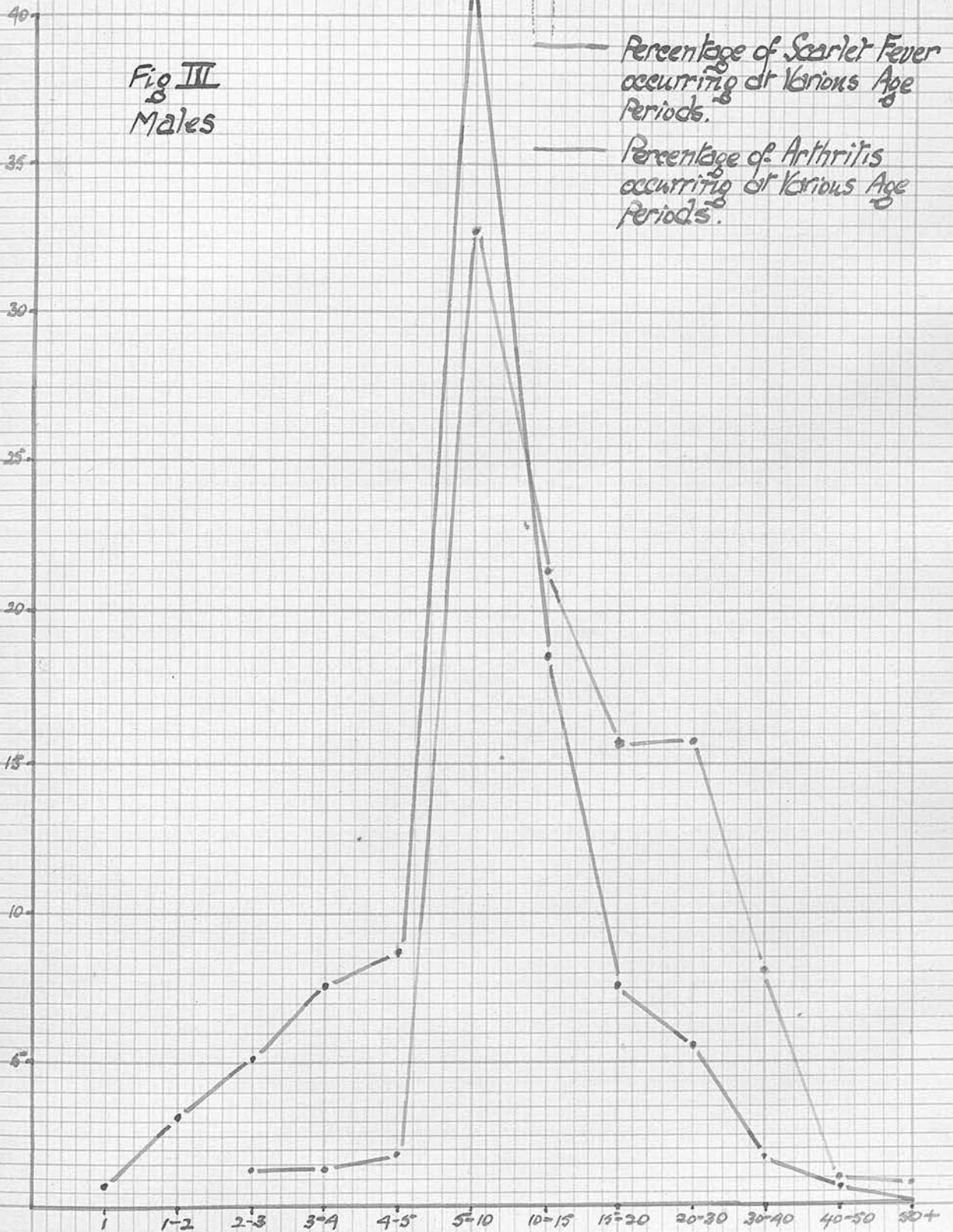


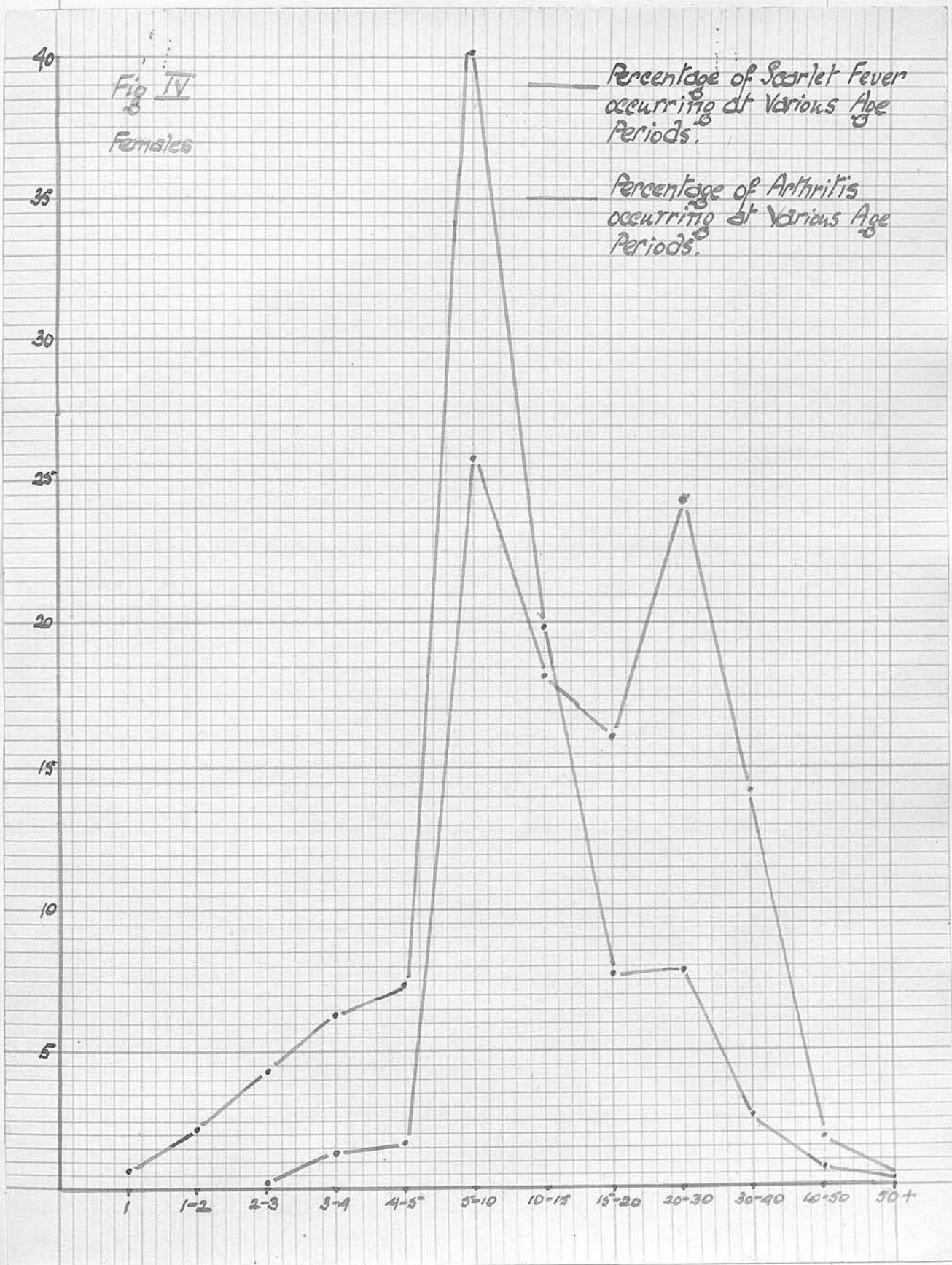
up to the end of their second year, admitted with scarlet fever, in not a single instance has arthritis been diagnosed. Here we are up against a difficulty in diagnosis since no symptoms, with the exception of a little frettness can be elicited from the patient, while in many cases the complication may appear and run its whole course with little or no disturbance in the shape of redness or swelling, or any physical sign whatever. To those accustomed to work in children's diseases it is an elementary fact that a temperature may go up and remain unsettled for a day or two without a cause ever being discovered and this state of affairs is no less common in the scarlet fever wards of an isolation hospital. Is it not a possibility that some of these unexplained temperatures are due to arthritis? Experienced ward Sisters consulted on this point have mentioned that this possibility has occurred to them, but the difficulty of obtaining proof is very great. Nearly every sick child resents handling and the fact of a child crying out when a joint is moved is no evidence that it is the pain of the movement that is the cause of the cry. However, in view of the large number of cases, 777 in all, of scarlet fever up to the end of the second year of life in which not one was even suspected of showing arthritis, we think we are on safe ground in assuming that the complication/

complication does not occur in these age periods. In this connection there is a fascination in the symmetry of the curves, and, based as they are on such a large number of cases, we are tempted to think they afford confirmation to some extent, if this were necessary, of a statement embodying the experience of nearly eight hundred cases, that the incidence of arthritis as a complication of scarlatina reaches zero in the early years of life.

The question of the excessive incidence of scarlatinal arthritis in females is an interesting one, and an attempt has been made to discover exactly in what way, if any, the incidence of arthritis in females differs from that in males. Is there simply an increase in the number of female cases of arthritis at all age periods or is there a difference in the distribution of the incidence? It has already been pointed out when discussing the curves in Fig. II that the female curve shows a more abrupt rise than the male between the ages of ten and forty. This difference can be brought out more clearly in another way and Figs. III and IV have been constructed for that purpose. In Fig. III a curve has been made to show the percentages of the total scarlet occurring in males at the various age periods using our 10,706 cases diagnosed as scarlet fever in the Edinburgh City/

Fig III  
Males





City Hospital. On this has been superimposed a curve showing the percentages of the total arthritis occurring in the same age periods in the same series of cases and by a comparison of the curves it is found that broadly speaking the curves are very similar, showing very much what was expected, namely, that at the age periods when there is the greatest number of cases of scarlet one finds the greatest number of cases of arthritis. Of all the cases of arthritis that are diagnosed in males, the greatest number is found in the age periods covering from five to fifteen years, the highest incidence of scarlet fever occurring of course, also at this time. A similar pair of curves has been made from the corresponding figures obtained from female records but the interesting fact emerges that in this case the curves do not follow each other very closely, for while a very great amount of arthritis occurs in female children at the age period when scarlet fever is most prevalent amongst them, there is another and almost as great a rise in the curve at the age period 20 to 30. Furthermore that part of the curve expressing the arthritis at the age period when scarlet is most prevalent in females does not rise so high as the corresponding segment of the male curve. This may be expressed more simply thus. The physician in charge of scarlet fever/



fever wards would expect to see the bulk of his cases of arthritis occurring in children between the ages of 5 and 15, simply because children of that age form the bulk of the population of his wards. In this assumption he would be perfectly right as far as males are concerned but he would be wrong with regard to his female patients, because he would find nearly as many cases of arthritis among women of 20 to 30 as in girls of 5 to 15, even though numerically the latter are to the former in the proportion of seven to one. It would appear therefore that the excessive incidence of arthritis as a complication in scarlet fever in females as compared with males, is mostly due to an increased susceptibility in females between the ages of 20 and 30 to suffer from that complication. This is an interesting point as it may have some bearing on the aetiology of the condition.

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TABLE VIII.

## PERCENTAGE INCIDENCE ON VARIOUS DAYS.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	
Males			3	10	14	24	25	15	14	5	4	3	3	2	6	2		3	1	2		1	4	3	4	3	
Females		1	3	21	31	34	33	18	19	6	4	3	5	2	4	4	2	4	1	1			2	1	2	2	
Total		1	6	31	45	58	58	33	33	11	8	6	8	4	10	6	2	7	2	3		1	6	4	6	5	
Males			1.6	5.4	7.5	12.9	13.5	8.1	7.5	2.7	2.1	1.6	1.6	1.1	3.1	1.1		1.6	.55	1.1		.55	2.1	1.6	2.1	1.6	
Females		.44	1.03	9.4	13.9	15.2	14.8	8.07	8.62	2.64	1.79	1.30	2.24	.89	1.79	1.79	.89	1.79	.44	.44			.89	.44	.89	.89	
Total.		.22	1.31	7.4	10.7	14.0	14.1	8.08	8.01	2.67	1.94	1.45	1.92	.99	2.44	1.44	.44	1.69	.49	.77		.27	1.49	1.02	1.49	1.24	
	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	Total
	4	5	3	1	1	1	1		1	5	2		2		1	1	1	1							1	185	
		2	3	1	2	2	1		2	2		1		1	2		1										223
	4	7	6	2	3	3	2		3	7	2	4	2	1	2	1	2	1	1						1	408	
	2.1	2.7	1.6	.55	.55	.55	.55		.55	2.7	1.1	1.6	1.1			.55	.55	.55	.55						.55		
		.89	1.3	.44	.89	.89	.44		.89	.89		.44		.44	.89		.44										
	1.05	1.79	1.45	.49	.72	.72	.49		.72	1.79	.55	1.02	.55	.22	.44	.27	.49	.27	.27						.27		

## PERCENTAGE INCIDENCE ON VARIOUS WEEKS.

Week	1st	2nd	3rd	4th	5th	6th	7th	8th.
Male	41.08	24.86	7.56	12.97	4.32	7.02	1.62	.54
Female	55.15	25.56	7.17	4.03	4.93	2.69	.44	
Total	48.77	25.24	7.35	8.09	4.65	4.65	.98	.24

DAY OF INCIDENCE.

To obtain data on which to come to a conclusion regarding the commonest time of appearance of the complication as many charts as could be obtained showing the complication were examined to find on which day the first symptoms appeared. In this way 408 cases were collected, 185 males and 223 females and the above table shows the result of the search. (Table VIII).

The cases are grouped into the various age periods but a study of the table shows that the age of the patient makes no difference to the time of appearance of the arthritis. Generally speaking the few cases that occur in the early and late age periods, when the complication is relatively uncommon, tend to appear at the same time as the great bulk of the cases occurring in the more susceptible age periods.

A graph has been constructed of the cases appearing on the various days for each sex (See Fig. VI) and an examination of the curves shows that the rise and fall of each is very similar, the obvious conclusion being that scarlatinal arthritis falls at the same point in the course of scarlet fever in both sexes. A second graph was then made taking the percentage of cases falling on the various days of the disease in/

Fig VI

Graph to Illustrate the Day of Incidence of 185 cases of  
Scarlatinal Arthritis in Males and 223 cases in Females

— Males, — Females

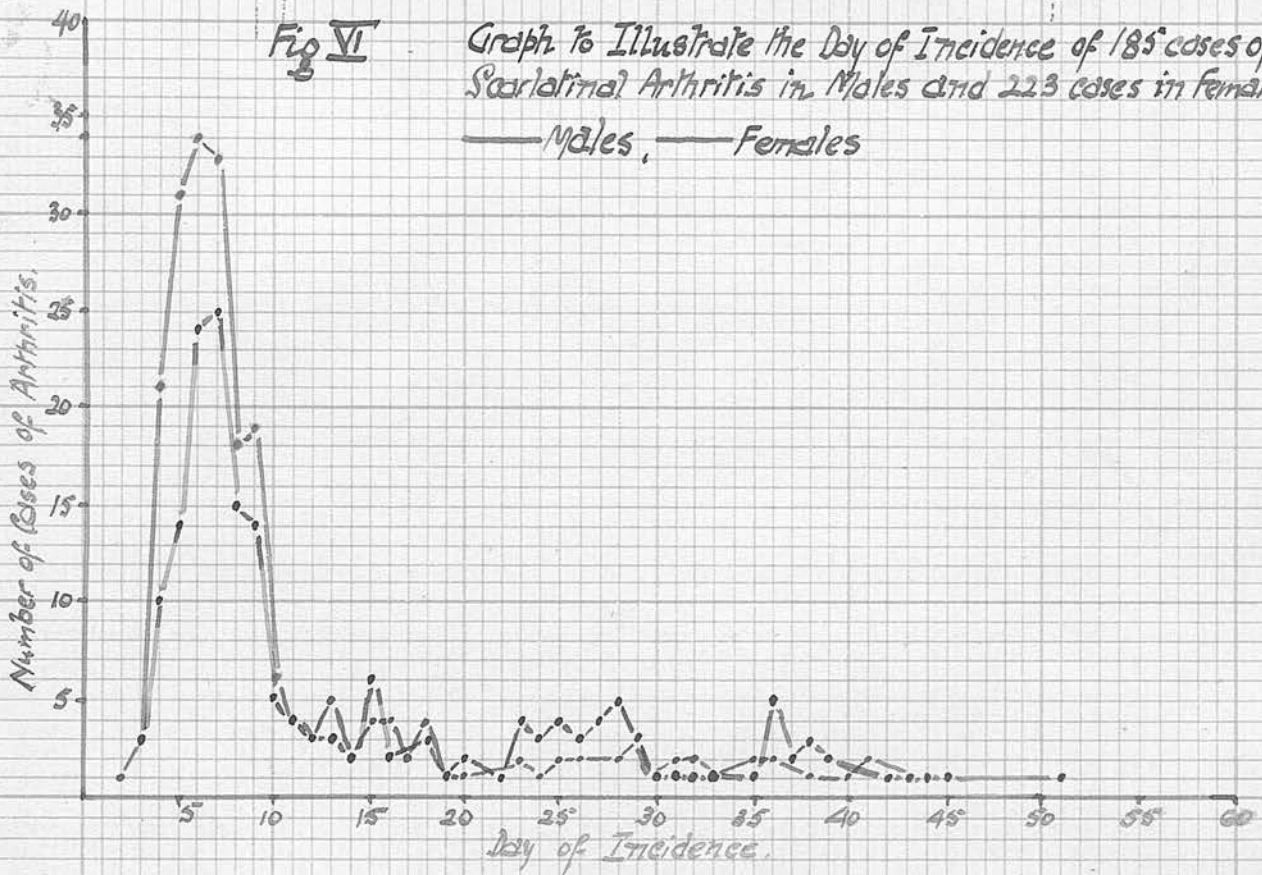
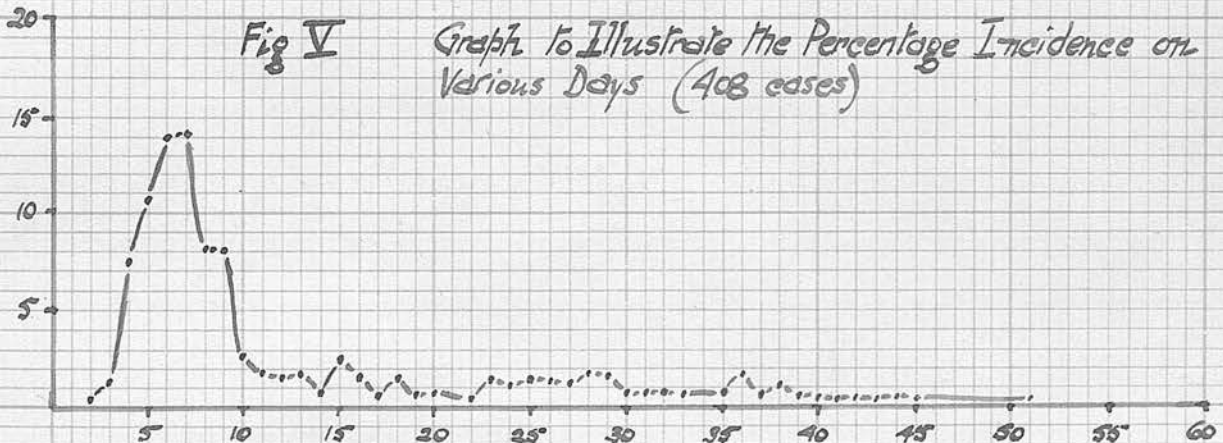


Fig V

Graph to Illustrate the Percentage Incidence on  
Various Days (408 cases)



in all the cases, and from that we can form an opinion as to the relative frequency of arthritis in the various stages of the fever. The first point that emerges is that in none of the 408 cases has arthritis appeared before the second day of illness. A small percentage appears in the second and third days, the percentage increasing rapidly in the fourth and fifth days till in the sixth and seventh days the crest of the wave is reached. From there onward the curve begins to drop as rapidly as it rose, with a slight hesitation on the eighth and ninth day till after the tenth day when the incidence is represented by a line which always threatens to reach zero but never quite does so, the latest case of the whole series appearing at no less an interval than fifty-one days from the onset of the fever. The sixth and seventh days are therefore the favourite days for the onset of scarlatinal arthritis and the great preponderance of cases appear between the third and tenth days.

From exactly the same set of figures as mentioned above a table has been drawn up to show the incidence of the complication in the various weeks and we find from that, that 48.77% of all arthritis occurs in the first week of illness, 25.24% in the second week, 7.35% in the third, 8.09% in the fourth, 4.65% in both fifth and sixth weeks, 0.98% in the seventh, and/

and 0.24% in the eighth.

This question of the time of onset of the complication is to be regarded as a point of some importance since an attempt has been made<sup>14</sup> to classify scarlatinal arthritis as belonging to either one or other of two types according to the period in the stage of the fever, early or late, that it appears. From a statistical point of view at all events this is hardly justifiable, since if we had two types of the complication we should expect to find two points of time in the course of the disease about which the cases tend to group themselves, always assuming of course that the same periodicity manifested itself in this as in the other features and complications of scarlet fever. Since practically seventy-five per cent of the cases appear in the first fortnight of the disease and the remaining percentage spaces itself out uniformly over the succeeding four or five weeks, it would seem much simpler to regard scarlatinal arthritis as of one type, the tendency for it being to appear early. Cases appearing later can then be regarded as merely atypical in time of appearance. Furthermore as no criterion can be applied to an arthritis occurring in the course of a convalescence from scarlet fever to differentiate the true scarlatinal rheumatism from a manifestation of previously existing rheumatism there/

there must be a certain number of cases of the latter appearing in the series as scarlatinal rheumatism and this would further reduce the number of so called "late" cases if a correction for this fallacy could be made. A practical point in the diagnosis of an arthritis appearing in the course of scarlatina as to whether it is a true scarlatinal arthritis or not, would be the time of its appearance, and if it did not fall within the usual limits then the case ought to be very closely examined with regard to its previous history to find out if there had been any previous tendency to true rheumatism. In view of the possible sequelae of the latter condition this point of diagnosis might become quite an important one.

Another aspect of the time of appearance of this complication is the point of view taken by those responsible for the discharge of patients from an isolation hospital. It is now the practice to discharge the scarlet convalescent at the end of his fourth week if no complications and no infectious discharges are present. It would hardly be expedient however to discharge a patient from a rate-supported hospital at a period when a complication of the disease for which he was isolated was likely to appear, however innocent that complication might be from the standpoint of infectivity and the public health.

The/

The likelihood of arthritis appearing after the patient has left hospital, though it might be unwise to completely lose sight of it, is very remote and could not be taken seriously as an objection to the modern practice that now obtains. Taking 3.76 per cent as a basis it would require a series of 26,595 cases of scarlet fever to give 1000 cases of arthritis and of these, one hundred and five might be expected to contract arthritis after their fourth week.

That means that about one patient in 253 may develop arthritis after discharge, assuming that all patients are sent home at the end of that time, and in spite of the assiduous attention of the otologist to ear and nose discharges, this happy state of affairs has not quite been arrived at.

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TABLE X.

## RELATIONSHIP TO OTHER COMPLICATIONS IN 408 CASES OF ARTHRITIS.

Complication.	Male	Female.	Total.	Percentage of Grand Total.
Adenitis	35	43	78	19.1%
Adenitis + Rhinitis	5	5	10	2.4%
Adenitis + Rhinitis + Otorrhoea	5	9	14	3.4%
Adenitis + Otorrhoea	3	2	5	1.2%
Adenitis + Rhinitis + Otorrhoea + Endocarditis.	-	1	1	.2%
Adenitis + Rhinitis + Pericarditis + Endocarditis.	-	1	1	.2%
Adenitis + Endocarditis	1	-	1	.2%
Adenitis + Nephritis	2	-	2	.5%
Rhinitis	3	4	7	1.7%
Rhinitis + Otorrhoea.	1	5	6	1.4%
Rhinitis + Otorrhoea + Nephritis + Otorrhoea.	2	3	5	.5%
Pericarditis	1	1	2	.5%
Endocarditis	1	4	5	.5%
Nephritis	3	1	4	.9%
Tonsillitis	2	2	4	.9%
Encephalitis	1	1	2	.5%
No other complications.	114	134	248	63.2%
Total	187	221	408	

TABLE IX.

## TABLE OF COMPLICATIONS IN CASES OF SCARLET FEVER SHOWING NO ARTHRITIS.

Complication.	1905.		1913.		1921.		Average of Three Years Male Female	Average Total of Both Sexes	%age of Grand Total.
	Male	Female	Male	Female	Male	Female			
	21	23	15	19	26	30			
Adenitis	5	4	5	4	8	3	20.6	23.6	44.2
Adenitis + Rhinitis	3	3	1	4	6	3	6	3.6	9.6
Adenitis + Rhinitis + Otorrhoea	2	6	4	5	7	5	3.3	3.3	6.6
Adenitis + Rhinitis + Otorrhoea + Endocarditis	-	-	-	-	-	-	4.3	5.3	9.6
Adenitis + Rhinitis + Pericarditis + Endocarditis	-	-	-	-	-	-	-	-	-
Adenitis + Endocarditis	-	-	-	-	-	-	-	-	-
Adenitis + Nephritis	-	-	-	-	-	-	-	-	-
Adenitis + Otorrhoea + Nephritis	2	2	4	1	1	-	1.6	.3	1.9
Adenitis + Rhinitis + Otorrhoea + Nephritis.	-	3	-	1	-	-	0.6	0.6	1.2
Rhinitis	10	4	11	6	17	7	-	1.3	1.3
Rhinitis + Otorrhoea.	5	3	1	2	4	4	12.6	5.6	18.2
Rhinitis + Nephritis + Otorrhoea	1	2	-	-	-	-	3.3	3	6.3
Rhinitis + Nephritis	-	1	-	-	-	-	0.3	0.6	0.9
Otorrhoea	12	16	3	3	6	9	7.	9.3	16.3
Pericarditis	-	-	-	-	-	-	-	-	-
Endocarditis	-	-	-	-	-	-	-	-	-
Nephritis	2	4	3	5	2	-	2.3	3	5.3
Nephritis + Otorrhoea.	-	-	-	1	1	-	0.3	0.3	.6
No other complication.	124	150	140	171	109	160	124.3	160.3	284.6
	187	221	187	221	187	221	186.5	220.4	406.9

RELATIONSHIP TO OTHER COMPLICATIONS.

In this enquiry the main objective was to discover if there was any connection between the incidence of any other complication or group of complications in Scarlet fever and Scarlatinal arthritis, and to this end two tables (Tables IX and X) have been compiled from equal numbers of cases of scarlet fever, a similar number of cases from each sex being used to make up the total number. In one series are found complications tabulated which have occurred in cases also showing arthritis, while in the other series are tabulated the complications of cases showing no arthritis. Furthermore since the 408 cases showing arthritis were obtained from records extending from 1905 to 1921, in order that the comparison might be as fair as possible, the series of cases in which no arthritis occurred is composed of an average taken between 408 cases in 1905, 408 in 1913, and 408 in 1921.

The first point that emerges from a comparison of these tables is that out of 408 cases of scarlet fever showing arthritis, 248 or 63.2% developed that complication alone. This important figure would seem to give a direct negative to the question of whether a direct relationship exists between arthritis and any of the other complications.

Taking/

Taking complications which are most frequently associated with arthritis it will be seen that adenitis as a single complication occurs in 10.8% of cases, while in combination with arthritis it occurs in 19.1%. The combination of adenitis, rhinitis and otorrhoea occur in 1.6% while, when arthritis is added, the combination occurs in 3.4%.

The other common complications such as rhinitis and otorrhoea, with their various permutations and combinations seem to occur about equally whether arthritis be also present or not, except in the case of rhinitis alone, which occurs in 4.4% of the cases where no arthritis is present, and in only 1.7% where arthritis is also a complication, and in the combination of adenitis with otorrhoea, which occurs in 2.4% of cases, and in only 1.2% where arthritis has also appeared.

Endocarditis appears with arthritis in 1.2% of cases, and not at all in the absence of arthritis, but this point has been considered of such importance that it has been taken up separately in another place. It is also a matter of interest that on the only two occasions in which an encephalitis has appeared during the course of a scarlet fever it has been accompanied in both cases by an arthritis, and the writer has been able to ascertain that the arthritis preceded the encephalitis in both instances.

Pursuing/

Pursuing the analysis further in the attempt to prove a relationship between other complications and arthritis, adenitis, rhinitis and otorrhoea have been selected as being the only promising ones. Taking adenitis it is found that it occurs either alone or in combination with some other complication (except arthritis) in 18.06% of cases of scarlet fever. In the presence of arthritis however it appears in 27.2% of cases of scarlet fever. Rhinitis in the same way appears almost equally in the presence or absence of arthritis, the percentages being 9.8 and 10.11 respectively, while otorrhoea appears exactly equally whether arthritis is present or not, in this case the percentage being 10.6.

On these somewhat superficial statistical grounds we would appear to have evidence that there is a relationship between arthritis and adenitis, but before accepting this it was thought that the figures should be subjected to a more critical scrutiny by a method of mathematical correlation. The figures furnish what is usually known as a fourfold table. Regarding the best method to select for examining these Pearson<sup>15</sup> writes, "the best method of inquiry at present for relative associations in the case of four-fold tables is, I hold, first to investigate P" (i.e. the probability that random sampling would lead to as large, or larger/

larger deviation between theory and observation)  
"and throw out as not associated those cases like the  
'Houses, built and building' alone" (i.e. those cases  
in which P is, mathematically speaking, of the order  
of  $\frac{1}{2}$ , or in other words; something larger than a very  
small fraction). "Then to use either tetrachoric  $r_t$   
or  $C_2$  according as we are justified in considering  
the variates as continuous or not". In this case it  
seems most reasonable to consider the variates as  
continuous, and hence the values of P and  $r_t$  have  
been determined according to the formulae supported  
by Pearson. The value for P was found to be 0.67  
so that by this method we come to the conclusion that  
there is no association between arthritis and adenitis.  
To show that there was an association between  
arthritis and adenitis, an infinitesimally small  
fraction would have been required since this would  
have represented that the probability that there was  
a non-association between adenitis and arthritis  
was negligible and that therefore, conversely, there  
was an association. The value P was so high here  
that there was no use in going further in the attempt  
to find a value for  $r_t$ .

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TABLE XI. RELATIONSHIP TO RELAPSES. (FEMALES)

Year.	1905	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	Total.	Percentage of Arthritis in Relapses.
Relapse	1	6	4	2	5	11	8	5	4	6	2	1	2	5	6	10	7	85	
Relapse + Arthritis	-	-	-	-	-	-	-	1	-	-	-	-	1	-	-	-	1	3	3.41

TABLE XV. RELATIONSHIP TO TYPE OF DISEASE. (FEMALES)

Year.	1905	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	Total.	Percentage of Arthritis in Septic Type.
Septic Type	11	12	11	27	13	8	6	11	12	8	15	17	5	20	15	10	6	207	
Septic Type + Arthritis	1	2	-	6	2	1	1	-	2	2	3	7	1	-	1	2	6	37	15.16

TABLE XIII. RELATIONSHIP TO HEART COMPLICATIONS. (FEMALES)

Year.	1905	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	Total.	Percentage of Heart Complications related to Arthritis.
Endocarditis	-	-	2	2	1	1	-	* 3	2	-	-	3	-	1	1	2	1	19	38.71
Endocarditis + Arthritis	-	1	-	2	1	1	2	-	-	1	-	1	2	-	-	1	-	12	
Pericarditis	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1	66.66
Pericarditis + Arthritis.	-	-	-	1	-	-	-	-	1	-	-	-	-	-	-	-	-	2	
Pericarditis + Endocarditis	-	-	-	1	-	-	-	1	-	-	-	1	1	-	-	-	-	4	33.33
Pericarditis + Endocarditis + Arthritis.	1	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	2	

\* 1 of these cases showed endocarditis on admission but whether due to the scarlet fever or whether it existed before the onset of the scarlet fever is not stated. No arthritis was developed.

From above figures, 40% of heart complications in scarlet fever are preceded by Arthritis.



TABLE XII. RELATIONSHIP TO RELAPSES. (MALES)

Year.	1905	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	Total.	Percentage of Arthritis in Relapses.
Relapse	1	6	5	4	8	11	4	8	5	9	2	3	4	9	4	9	21	113	
Relapse + Arthritis	-	1	1	-	1	-	-	-	1	1	-	1	-	-	-	-	-	6	5.04%

TABLE XVI. RELATIONSHIP TO TYPE OF DISEASE. (MALES)

Year.	1905	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	Total.	Percentage of Arthritis in Septic Type.
Septic Type.	10	18	16	58	60	52	17	17	25	24	29	20	14	24	23	9	19	435	
Septic Type + Arthritis	5	1	1	2	2	4	-	1	1	1	-	-	1	1	2	1	-	23	5.02%

TABLE XIV. RELATIONSHIP TO HEART COMPLICATIONS. (MALES)

Year.	1905	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	Total.	Percentage of Heart Complications related to Arthritis.
Endocarditis	1	-	-	-	2	-	1	1	1	-	1	-	1	-	1	1	-	9	30.77%
Endocarditis + Arthritis.	-	-	-	-	1	-	1	-	1	-	-	-	-	1	-	-	1	4	
Pericarditis	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	1	83.3%
Pericarditis + Arthritis	-	-	1	1	1	-	-	-	-	-	-	2	-	-	-	-	-	5	
Pericarditis + Endocarditis.	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	50%
Pericarditis + Endocarditis + Arthritis.	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1	

From above figures 47.62% of all heart complications in Scarlet fever are preceded by arthritis.

RELATIONSHIP TO HEART COMPLICATIONS.

This investigation was carried out by examining the records of all cases in the City Hospital from 1905 till 1921 and noting the occurrence of endocarditis, pericarditis or both, and whether or not these were associated with arthritis. (Tables XIII and XIV).

During the whole of that time endocarditis, the commonest of the cardiac complications, occurred alone 44 times, being divided between the sexes in the proportion of 31 females to 13 males. Of these 44 cases of endocarditis, 16 were associated with arthritis, making a percentage of 36.4.

Pericarditis occurring alone is relatively much less frequent, only 9 cases being noted over the same period. Of these 3 occurred in females and 6 in males and no fewer than seven out of the nine showed an associated arthritis, a percentage of 77.

Pericarditis and endocarditis together occurred 8 times, six times in females and twice in males. An associated arthritis occurred in three of the cases, making a percentage of 37.5.

Endocarditis and pericarditis are thus relatively uncommon complications of scarlet fever. On adding up the whole of the above we find that the heart was involved by endocarditis or pericarditis or both on/

on 61 occasions, out of a total of 24,012 cases examined in that time. Calculated as a percentage this works out at 0.25%, while endocarditis makes 0.22 per cent. The latter figure is interesting for comparison with the Metropolitan Asylum's Board figures of 0.58 per cent calculated on an almost equal number of cases, namely 22,096, and McCollom's<sup>16</sup> of 0.3 per cent calculated on 1000 cases. These figures would seem to bear out the views of Ker<sup>4</sup> and Caiger<sup>11</sup> that scarlet fever as an aetiological factor in the production of heart disease is almost negligible. Poynton, however, makes the statement that "much of the heart disease connected with scarlet fever has, in my experience, arisen after the child has left the fever hospital"<sup>17</sup> and Osler also declares that "it is not uncommon in scarlet fever " while later he mentions while speaking of the prevention of endocarditis in the eruptive fevers, that "it is probable that many cases arise, particularly in children, in mild forms of these diseases"<sup>18</sup>. John Thomson<sup>19</sup> also writes that "apparently scarlet fever acts as a strongly predisposing cause of acute rheumatic fever" the latter term in this connection including cardiac manifestations principally. It is by no means impossible to reconcile the above somewhat contradictory and weighty evidence and this may be done by assuming that cardiac complications/

complications are rare during the course and convalescence from scarlet fever, but that persons, having suffered from scarlet fever are more prone to suffer at some future date from heart lesions of a rheumatic nature. Facts bearing on this point from a children's hospital are valuable, and Poynton in the Hospital for Sick Children, Great Ormond Street, has collected twenty-five cases of scarlatinal rheumatism in which he was able to trace the after-histories over some years.<sup>21</sup> He comes to the conclusion that "heart disease is a common event in childhood after scarlatinal rheumatism. Thus 16 out of 25 had obvious organic valvular disease, and several of the remainder had dilated hearts or suspiciously feeble first sounds". In this paper it is shown that months may elapse between the discharge from fever hospital and the appearance of other manifestations of rheumatism, and obviously provides the basis for the general statement made years later and attributed in a former reference to Poynton. He makes the further interesting point that one symptom of rheumatism may be noted when a child is in fever hospital, which may quiet down under treatment, but in a month or two after departure, another symptom frequently appears.

The next point that arises is, whether or not there is any relationship between scarlatinal arthritis and heart complications occurring definitely in the course/

course of an attack of scarlet fever and we find from our statistics that 26 out of 61 of our cases of organic cardiac involvement are associated with arthritis, that is, 42.6 per cent. These figures may be put in another way. It was found previously that 24.012 cases of scarlet fever showed arthritis 905 times, i.e. 23107 cases of scarlet fever showed no arthritis. These 23107 cases are therefore associated 31 times with cardiac complications while the 905 cases are associated 26 times with cardiac complications, the percentages being respectively 0.15 and 2.87. These figures in themselves supply presumptive evidence that the irritant in joint and heart complications of scarlet fever is the same, while the analogy of other acute infectious processes where the aetiological factor is known and which are liable to be complicated by inflammations of joints and heart, e.g. gonorrhoea, make it also most probable. That being so, the convalescent scarlet fever patient who has suffered from scarlatinal arthritis should be treated with circumspection, and it might be wise to pay very great attention to the routine examination of the heart in these cases, particularly before discharge, making special note of impurity of sounds or enlargement. This would be a useful contribution towards the solution of a problem which Poynton<sup>17</sup> regards "at/

"at present the most practical in the whole range of the study of heart disease - the possibility of preventive measures." Arthritis, in the great majority of cases occurs early in the fever; it ought to be a matter of little difficulty to keep a watchful eye on such cases, with a view to applying early the principles in the management of such cases which, as far as our knowledge goes at the moment, would seem the only line of treatment.

#### RELATIONSHIP TO TYPE OF DISEASE.

The consideration of the relationship of the occurrence of arthritis to the type of the disease practically resolves itself into an enquiry into the frequency of the occurrence of arthritis in the septic type of scarlet fever. The malignant type is sufficiently rare to prevent the figures having any weight, and in any case runs to a fatal termination before arthritis has any chance of appearing. After deducting the cases therefore that appear in the septic type, we assume that the remainder occur in the simple type of Scarlet.

The table (Table XVI) containing the number of septic cases in males in the City Hospital, Edinburgh, from/

from 1905 till 1921, shows that the total number of cases of the septic type was 458 and of these 23 developed arthritis as a complication, a percentage of 5.02. The corresponding table for the females (Table XV) reveals that there were 244 septic cases and of these 37 showed arthritis, making the high percentage of 15.16. Taking both sexes together we find that the incidence of arthritis in the septic type works out at 8.54, a figure greatly in excess of the incidence in all cases, which was found to be 3.76 per cent. The excessive incidence in females is striking.

The main point in approaching this investigation was to find out if the septic type of scarlatina has any greater liability to develop arthritis than the simple type, and there can be no question that the above figures bring that out very prominently. Examining our figures by the same method as was adopted in regard to the incidence of heart complications we find that in simple scarlet fever arthritis occurred 845 times, while in 702 cases of the septic type arthritis occurred in 60 cases, the percentages working out at 3.62 and 8.54 respectively. From that it will be seen that arthritis is more than twice as likely to happen in the course of a case of the septic type as in the simple type.



RELATIONSHIP TO RELAPSES.

The occurrence of arthritis as a complication in relapses during the course of scarlet fever has been worked out in the same way as the occurrence in the septic type (Tables XI and XII). All the case records from 1905 till 1921 were examined and those showing relapses were noted according to whether they had developed arthritis or not. In this way it was found that of 119 cases of relapsed scarlet fever in male patients 6 showed arthritis, a percentage of 5.04. In the females 88 relapses occurred, of which 3 developed arthritis, a percentage of 3.41. In all cases of relapsed scarlet fever arthritis occurred in 4.35 per cent of cases. A point that would have been interesting, and possibly of some value, unfortunately did not emerge from the records, namely, whether the complication occurred during the initial attack, or during the relapse. That arthritis may be a complication in a relapse is unquestionable but it may safely be assumed from the above figures that it is no more common in relapses than in ordinary cases, otherwise the percentage would be higher than it is. The slight increase above the average incidence of 3.76 is probably due to the comparatively small number of cases on which the percentage is calculated.

TABLE XVII. MONTHLY AND SEASONAL INCIDENCE OF SCARLET FEVER AND ARTHRITIS. (continued)

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Totals.
1906	1	-	2	6	3	3	1	1	3	3	3	2	28
	39	34	52	56	35	20	35	24	29	27	26	45	422
1908	2	1	1	8	6	7	7	-	2	6	7	6	53
	75	82	72	81	94	64	90	52	87	112	72	84	965
1909	4	1	3	1	1	-	4	-	7	6	6	3	36
	53	46	51	32	44	44	73	72	108	94	88	49	754
1910	2	1	1	1	-	1	6	-	-	2	5	-	19
	43	42	71	40	46	43	53	62	79	88	79	88	734
1912	-	-	1	3	2	1	-	-	1	2	2	1	13
	44	26	33	21	37	30	32	19	30	64	33	50	419
1913	-	2	-	1	2	3	1	1	1	15	8	2	36
	56	45	39	32	32	43	49	43	60	238	137	115	889
Total Arthritis.	16	10	21	25	26	24	32	10	27	53	40	24	
Total Scarlet Fever	699	553	655	583	576	564	656	540	825	1174	924	848	
Percentage	2.28	1.80	3.20	4.28	4.51	4.25	4.87	1.85	3.27	4.51	4.32	2.83	

1st Quarter 2.46%, 2nd Quarter 4.35%, 3rd Quarter 3.41%, 4th Quarter 3.97%

TABLE XVII. MONTHLY AND SEASONAL INCIDENCE OF SCARLET FEVER AND ARTHRITIS.

	Scarlet Fever in Red.												Totals.
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1911	-	-	1	-	1	-	-	2	1	1	-	1	7
	55	34	55	30	20	25	30	32	35	53	38	62	449
1912	1	1	-	1	-	1	-	-	-	1	1	1	7
	35	19	30	16	33	31	34	30	30	49	38	55	400
1914	1	1	6	1	6	3	3	3	2	7	4	2	39
	92	59	62	73	66	78	82	70	124	161	109	71	1047
1915	2	1	1	1	1	-	1	1	1	1	1	1	12
	60	47	53	48	35	52	56	47	81	111	154	94	838
1916	1	2	2	1	2	2	2	-	1	2	2	2	19
	81	56	81	70	54	51	51	39	50	59	45	36	673
1917	2	-	1	1	1	2	3	-	3	3	-	2	18
	40	36	19	34	39	44	37	23	40	44	54	44	454
1918	-	-	2	-	1	1	4	2	5	4	1	1	21
	26	27	57	50	41	39	34	27	72	84	51	55	563

Males

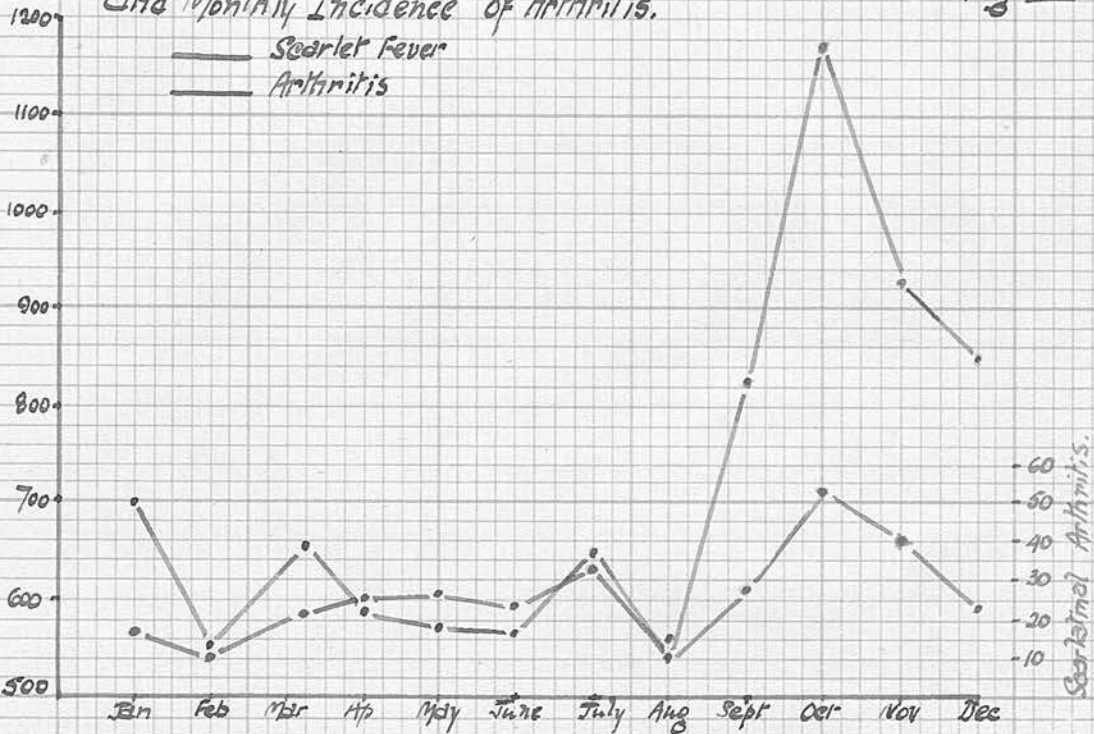
MONTHLY AND SEASONAL INCIDENCE.

This was worked out for males in the years 1911, 1912, 1914, 1915, 1916, 1917, 1918, and for females in 1906, 1908, 1909, 1910, 1912, 1913, these particular years being chosen as being all the years since 1905 in which a search through the charts of the scarlet fever cases admitted to the City Hospital, Edinburgh, revealed the same number of cases of arthritis as was recorded in the ward "Scarlet fever" books. By this method 308 cases of arthritis have been obtained. It was thought absolutely necessary to have every single case of arthritis occurring in a year before attaching any importance to the particular months in which these cases fell and thus arriving at a proper conception of the seasonal prevalence of this complication. Finally in order to give the various monthly prevalences some common basis for comparison, the total number of cases of scarlet fever that occurred in each month of the various years was found and the arthritis for each month worked out as a percentage. A table of the actual figures obtained by these various procedures is included and two graphs prepared, one to show the monthly incidence of scarlet fever and the monthly incidence of arthritis, and the other to show the monthly percentage incidence of arthritis.

The/

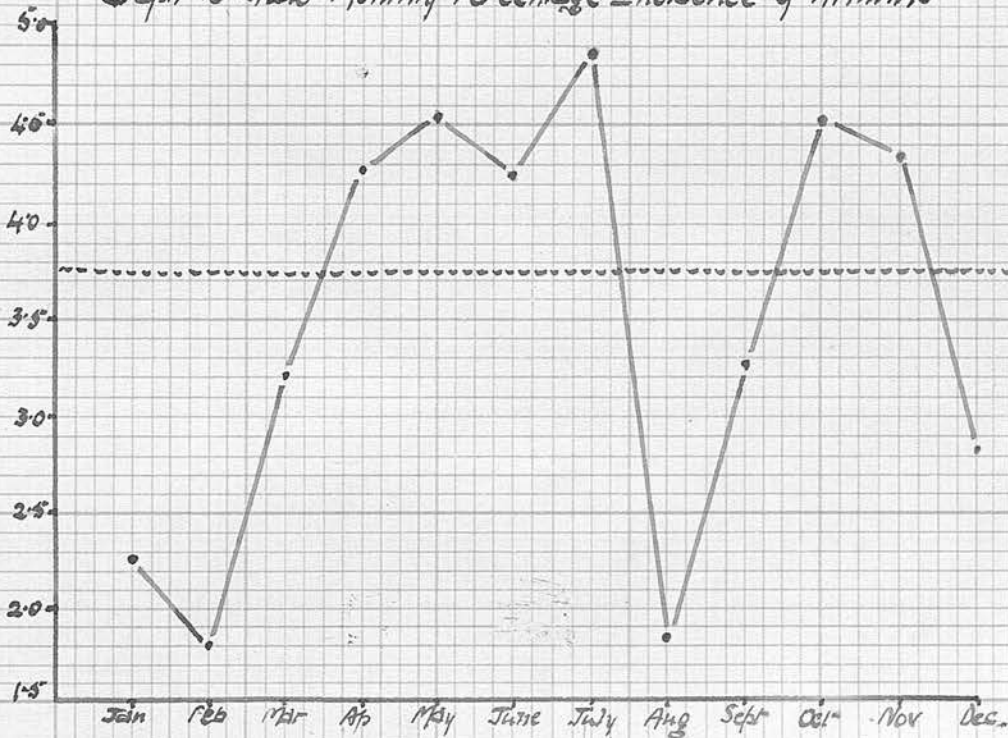
Graph to Show Monthly Incidence of Scarlet Fever and Monthly Incidence of Arthritis.

Fig VII



Graph to show Monthly Percentage Incidence of Arthritis

Fig VIII.



The curves of the incidence of scarlet fever and arthritis correspond fairly closely except during April and May when the arthritis curve shows a slight rise while the scarlet fever curve is dropping. On all other occasions the curves rise and fall simultaneously. The amount of arthritis therefore is proportionate to the amount of scarlet fever throughout the year except during the months of April and May when the amount of arthritis would seem to increase while the amount of scarlet fever is decreasing.

The percentage of arthritis to scarlet fever in the various months also gives an interesting curve and probably affords the best criterion of the monthly and seasonal incidence. The highest point is reached in July, which shows an incidence of 4.87 per cent, and the lowest in February and August, which show 1.80 per cent and 1.85 per cent respectively.

A dotted line has been made at the average percentage level for all cases, namely 3.76 per cent, the curve rising above this during the months April, May, June and July, and again during October and November.

During the winter months December, January and February, the incidence is very definitely below the average.

From the table when divided into quarters, the first and second quarters show the lowest and highest percentage incidences, being 2.46 per cent in the first as/

as compared with 4.35 per cent in the second. In the third and fourth quarters the percentages are 3.41 and 3.97 respectively.

These figures do not quite bear out the statement of Caiger<sup>11</sup> that "it (Scarlatinal arthritis) arises independently of season, being as common in the summer and autumn months as in the colder season." According to the above results it would actually seem to be commoner in the summer and autumn months than the particular months, December, January and February that are conventionally designated winter in this country. It is interesting to compare this seasonal incidence with that of acute rheumatic polyarthritiis, which Newsholme<sup>20</sup> found to show "a curve of incidence in London reaching a maximum in the autumn, the apex of the curve usually being about October or November".

With regard to season, the highest percentage incidence of scarlatinal arthritis occurs in the second quarter of the year as compared with a maximum number of cases in London of acute rheumatism in October or November. It is important to note however that October or November shows the maximum incidence of scarlet fever and Newsholme has associated both scarlet fever and true acute rheumatism with an abnormally low subsoil water and a high earth temperature.

The age incidence of scarlatinal arthritis shows

THE RELATIONSHIP OF SCARLATINAL ARTHRITIS  
TO ACUTE RHEUMATISM.

Certain observers have expressed views that scarlatinal arthritis is really a form of true acute rheumatism. Thus it has been seen above that Caiger considers the two conditions "pathologically akin" while Poynton<sup>21</sup> goes so far as to say that scarlatinal rheumatism is "in many cases true acute rheumatism". Before going on to discuss the aetiology of scarlatinal arthritis it might be well therefore to institute a comparison between the two conditions, taking up the main points in more or less systematic text-book fashion and using the information that the foregoing investigations have produced.

With regard to season, the highest percentage incidence of scarlatinal arthritis occurs in the second quarter of the year as compared with a maximum number of cases in London of acute rheumatism in October or November. It is important to note however that October or November shows the maximum incidence of scarlet fever and Newsholme has associated both scarlet fever and true acute rheumatism with an abnormally low subsoil water and a high earth temperature.<sup>20</sup>

The age incidence of scarlatinal arthritis shows a/



a tendency to increase with age up to the age period 30 to 40, whereas according to the statistics of the Montreal General Hospital quoted by Osler<sup>18</sup>, the highest incidence of acute rheumatism is in the age period 15 to 25. Acute rheumatism does not occur under the age of two, and is very rare before three, in this respect resembling scarlatinal arthritis.<sup>23</sup>

It has been shown that scarlatinal arthritis is nearly twice as common among females as males, and also that this excess among females is mainly due to an increased susceptibility at the age period 20 to 30. No such complete statistics are available for acute rheumatism, but Osler states that, if all ages are taken, males are more frequently affected than females, but that up to the age of twenty, females predominate. Poynton's statistics agree with this.<sup>24</sup>

It has been noted that authorities are agreed that there are no characteristic differences in the morbid anatomy of scarlatinal arthritis as it occurs in the vast majority of cases, i.e. without suppuration, and acute rheumatism.

The clinical features of the two conditions make an interesting comparison. The definite appearance of the preponderance of joint inflammations within the first ten days of scarlet fever has no counterpart in the shape of an incubation period for acute rheumatism. The predisposition of patients with a previous/

previous history of rheumatism to scarlatinal arthritis, and the sore throat, which, according to Dingwall Fordyce<sup>23</sup>, may affect the tonsils and soft palate in acute rheumatism and thus bring it very close to scarlet fever, are significant. The symptoms and signs of scarlatinal arthritis resemble acute rheumatism in the characters of the local manifestations in the joints, (which, however, in the former are invariably much milder), in the infiltration of the periarticular tissues, and the tendency to involve neighbouring tendon sheaths. The pain is practically never so severe as in acute rheumatism, and there is not the marked constitutional disturbances in the shape of prostration and the sour-smelling sweats. A tendency to hyperpyrexia is typical of the classical case of acute rheumatism in the adult but in childhood is "a very unusual event indeed. Many cases of rheumatism run a course of moderate fever (102°F),"<sup>24</sup> and in this particular point the two conditions appear similar. The duration of the condition in the average case of scarlatinal arthritis is about six days, whereas in acute rheumatism even the mildest attacks seldom settle down under three weeks. It has been shown that it is mainly the small joints that are affected in scarlatinal arthritis whether adult or child is the subject of the attack, whereas in rheumatism it is mainly the large joints which suffer.

The/

The flitting from joint to joint in both cases is similar. On the point of heart complications a statement is not easy to make, but perhaps the best way to put it is, that, while a scarlatinal arthritis is occasionally beset by a heart complication, Osler found 35 per cent of his cases of acute rheumatism acquired endocarditis and 6 per cent pericarditis.<sup>18</sup> Lastly with regard to the effect of the salicylates, the concensus of opinion is against their being of benefit in scarlatinal arthritis, while in acute rheumatism they have come to be regarded as almost specific.

To sum up, the points of resemblance of scarlatinal arthritis to acute rheumatism are chiefly clinical, and this is what we should expect from a consideration of the pathology of joint inflammations, a great number of different kinds of irritants being able to set up the same reaction. The susceptibility to scarlatinal arthritis of rheumatic patients may be explained by the previous rheumatism having made their joints more vulnerable. Such differences as are found however in the age and sex incidence, in the joints involved, in the severity of the process, in the relative frequency of endocarditis and pericarditis, in the reaction to salicylates, and in the view of the writer, the extraordinary constancy of the time of appearance/

appearance of the complication during the course of the disease, make it difficult to believe that we are dealing with one and the same condition. For the purposes of future discussion therefore scarlatinal arthritis will be regarded as a separate clinical entity.

The arthritis may be due to the causal factor of scarlet fever, secondly, it may be caused by a secondary pyogenic organism or its toxins, and lastly, the arthritis may be a manifestation of some anaphylactic phenomenon such as is met in serum sickness.

Before going on to discuss these possibilities it might be well to point out that Walden made a bacteriological examination in 30 cases, making a blood culture from each patient, and in addition drawing some of the effusions into the joint cavity or some of its pouches. All the blood cultures were sterile, while in three cases of fluid from the joints, organisms were cultured which were regarded as contaminations. This result is in accord with the single case in which the writer made a bacteriological examination of a joint effusion. More observations obviously require to be made, since definitely supported evidence in one or two cases in favour of an organism would discount these purely negative results. Such as they are, however, they are suggestive.

Since we are still in ignorance of the causal agent of scarlet fever, this factor cannot be ruled out.

AETIOLOGY OF SCARLATINAL ARTHRITIS.

In a discussion on the aetiology of the complication we are faced with three possibilities. First, the arthritis may be due to the causal factor of scarlet fever, secondly, it may be caused by a secondary pyogenic organism or its toxins, and lastly, the arthritis may be a manifestation of some anaphylactic phenomenon such as is met in serum sickness.

Before going on to discuss these possibilities it might be well to point out that McClure<sup>s</sup> made a bacteriological examination in 30 cases, making a blood culture from each patient, and in addition drawing off some of the effusion into the joint cavity or some of its pouches. All the blood cultures were sterile, while in three cases of fluid from the joints, organisms were cultured which were regarded as contaminations. This result is in accord with the single case in which the writer made a bacteriological examination of a joint effusion. More observations obviously require to be made, since definitely supported evidence in one or two cases in favour of an organism would discount these purely negative results. Such as they are, however, they are suggestive.

Since we are still in ignorance of the causal agent of scarlet fever, this factor cannot be ruled out/

out as a possibility. The modern view is that scarlet fever is due to a streptococcus or a protozoon, while recently a filter passer has been suggested. In giving a review of the literature on the subject, Zinnser<sup>25</sup> states that "we cannot, as yet, justly conclude that streptococci are actually the aetiological agents of this disease", while Muir and Ritchie<sup>26</sup> agree that "at present no definite opinion can be expressed as to the aetiological relation of streptococci to scarlet fever." It is of interest however to note in this connection, that in a private conversation with the writer, the late Professor Ritchie expressed the view that a streptococcus would eventually be found to be the cause. In view of the particular object of this paper, Mair's work on the aetiology of scarlet fever is of interest. He reports that in his attempts to produce experimental scarlet fever in the monkey, one of his animals, which had received an injection of mouth-washings from a mild case of scarlet fever in its fourth day, developed a positive reaction, and on the ninth day after the inoculation developed a painful arthritis and tenosynovitis of the left ankle which remained for ten days and then cleared up completely. In another animal, a similar condition lasting a few days was produced after the fifth injection, the date of the first injection not being stated. In his summary/

summary he writes "Another feature common to the disease in man and the monkey is scarlatinal rheumatism" referring to the disease produced by the diplococcus scarlatinae, an organism isolated by himself and which he regards as the causal organism.<sup>27</sup> In another paper he states further<sup>28</sup> "If the interpretation placed upon the experimental results described in this paper be correct, then we must regard scarlet fever as a disease analogous to diphtheria, where the infective agent, gaining only a slight foothold in the tissues at a local focus, is able to produce a toxin which is poured into the blood. The Pyrexia and exanthem and changes in the leucocytes are the direct result of the action of this toxin, as is also probably the arthritis when this occurs." These results were produced by an organism resembling the pneumococcus, but possibly belonging to the large family of streptococci, and whatever Mair's criteria of a positive reaction denoting scarlet fever were, we know that lesions can be caused in animals which reproduce most of the features of acute rheumatism as it occurs in man, by streptococci obtained from sources quite unconnected with rheumatic infection.<sup>29</sup> That is to say, almost any streptococcus when introduced into the blood stream of animals, will produce an arthritis. So that Mair's organism, while producing an arthritis, may not/

not necessarily be the cause of scarlet fever, and if not, then the arthritis can hardly be regarded as scarlatinal rheumatism.

On the subject of the protozoal theory of the origin of Scarlatina, the work of Field<sup>30</sup> has failed to corroborate the work of Mallory<sup>31</sup> who described a parasite resembling the plasmodium of malaria, the cyclaster scarlatinalis, and which he thought was the cause of scarlet fever.

With regard to our second probability, the proposition that arthritis is caused by a secondary invading streptococcus or its toxins has much to be said for it. The suppurative complications such as otitis and rhinitis, and the sore throat associated with the onset of the fever are due to the action of a streptococcus in a considerable number of cases, while further, we have seen that arthritis is a much more frequent complication of the septic type of disease than the simple, and there can be little doubt that the septic type is due to a superadded streptococcal infection. Against these points we must place McClure's failure to isolate the organism, and if this hypothesis is to be maintained, the action of a toxin must be held to be a responsible factor, a hypothesis which, it may be pointed out, has not a great deal of bacteriological evidence in favour of it, since the work/



work on streptococcal toxins is very conflicting.

Lastly we come to the anaphylactic theory which is the one supported by McClure in view of his negative bacteriological findings. Clinically the joint conditions in serum-sickness resemble very closely the conditions found in scarlatinal arthritis. Zinnser states that these often show "very little, if any, objective symptoms in the joints". It attacks mainly the smaller joints according to McClure, and, like scarlatinal arthritis, is not benefitted by the use of salicylates internally. In Ker's series of 1,142 cases showing serum sequelae, quoted in his "Text book of Infectious Diseases", nine cases showed joint pains as the sole manifestation of the serum disease, and of these five appeared from the ninth to the twelfth days. These points make the analogy very complete. Briefly the condition is thought to be due to an interaction of the antigen which had not yet disappeared from the blood, with antibodies which were already being actively brought into being<sup>32</sup>, and attempts have been made to explain other phenomena of the exanthemata on the same basis.<sup>33</sup>

To sum up, the choice of aetiological factor would seem to lie between the streptococcus and anaphylaxis. Whether the streptococcus be also the cause/

cause of the primary condition or merely a secondary invader, or whether it is the organism itself or merely a toxin need not concern us. When the cause of scarlet fever is discovered, we shall be far on the way to settling the question of the aetiology of scarlatinal arthritis.

It is often accompanied by morbid anastosis, and is often accompanied by teno-synovitis or myositis or both.

1. Of thirty-three cases of scarlatinal arthritis, seven were preceded by a "dirty" throat, the remaining twenty-six showing the facial congestion and slight enlargement of the tonsils typical of the average case of scarlet fever.

2. Of thirty cases of arthritis in which an accurate previous history could be obtained, five gave a definite history of rheumatism, and a sixth a history of occasional joint pains.

3. The onset is usually gradual, taking about twelve hours to develop, pain and temperature being the first indications of the appearance of the arthritis.

4. The pain shows all variations from a mere stiffness to the most acute pain. The pain however is not usually severe and is often described as dull and gnawing in character, it gives on movement.

S U M M A R Y.

1. Scarlatinal arthritis is a transitory condition, similar to the arthritis occurring in other infectious diseases to which it has a similar morbid anatomy. It is often accompanied by teno-synovitis or myositis or both.
2. Of thirty-three cases of scarlatinal arthritis, seven were preceded by a "dirty" throat, the remaining twenty-six showing the faucial congestion and slight enlargement of the tonsil typical of the average case of scarlet fever.
3. Of thirty cases of arthritis in which an accurate previous history could be obtained, five gave a definite history of rheumatism, and a sixth a history of occasional joint pains.
4. The onset is usually gradual, taking about twelve hours to develop, pain and temperature being the first indications of the appearance of the arthritis.
5. The pain shows all variations from a mere stiffness to the most acute pain. The pain however is not usually severe and is often described as dull and gnawing in character, is worse on movement, /

movement, and may cause an attitude relaxing the joint tissues to be adopted. It usually lasts for one or two days.

6. Tenderness is rarely seen in a joint affected by scarlatinal arthritis.
7. Swelling was absent in thirty out of forty-nine cases, and in the cases in which it did appear was small in amount. It does not disappear in one joint on another being involved.
8. Redness is practically never seen in a joint affected by scarlatinal arthritis.
9. Heat may be felt in nearly every case.
10. Temperature was absent in seven cases out of forty-nine in which the complication appeared. In six of these cases the arthritis was of a mild type. Out of 53 female cases, the temperature was above the normal during two to five days in 39 cases, and out of 50 male cases, 42 cases remained above the normal from two to five days.
11. The pulse in scarlatinal arthritis is proportionate to the rise in temperature.
12. In 49 cases the order of involvement of joints was, wrists 27.34 per cent, interphalangeals of hand/

hand and metacarpophalangeals 22.20 per cent, knees 14.52 per cent, shoulders 14.09 per cent, elbows 12.82 per cent, ankles 7.25 per cent; temporomandibular, interphalangeals of foot, hip, and metatarsophalangeals 0.42 per cent each.

The joints affected are the same in both sexes, and both sides of the body suffer equally. The age of the patient does not affect the distribution of the joints affected, the small joints being predominantly affected always. Out of 49 cases, the joints were attacked symmetrically in 23 cases, 16 were practically symmetrical, 8 completely asymmetrical and 2 incompletely so. There was no difference in the joints involved according to the date of incidence of the complication. The average number of joints involved is 4.77 per person, males showing an average of 4, and females a fraction over 5. There is no difference in the number of joints involved according to whether the arthritis appears early or late in the complication.

13. In 48 cases the average duration of the attack was 5.9 days, and none of the factors of sex, date of incidence in the fever, the age of the patient, /

patient, had any effect on the duration of the attack.

14. Out of 49 cases, eleven showed myositis in addition to arthritis. The muscles of the arm and forearm were involved in five cases, the quadriceps femoris in three, the calf muscles in two, the lumbar, the trapezius and sternomastoid in one case each.
15. In 16 cases treated by salicylates internally, 8 showed extensions and recurrences in other joints after the treatment was started, 6 showed no further involvement and the condition cleared up in one or two days, one reacted at once to aspirin, and one went on to endocarditis, pericarditis and death. The average duration of these cases was 6.9 days as compared with 5.9 of the series quoted above.
16. Calculated on 24,012 cases, observed over a period of sixteen years inclusive, the percentage incidence of scarlatinal arthritis is 3.76 per cent. In the males it occurred in 2.71 per cent of cases, and in the females in 4.65 per cent.

17./

17. The liability to contract scarlatinal arthritis increases with age in both sexes. The excessive liability of females to suffer from this complication appears to be due to a greatly increased susceptibility among females between 20 and 30.
18. The sixth and seventh days of scarlet fever are the favourite days for the appearance of scarlatinal arthritis, the great majority of cases appearing between the third and tenth days. The age of the patient has no effect on the time of appearance of the complication.
19. Out of 408 cases of scarlet fever showing arthritis, 63.2 per cent showed that complication alone. Adenitis occurs alone in 10.8 per cent of cases, but when associated with arthritis occurs in 19.1 per cent of cases. Adenitis alone, or in conjunction with some other complication (except arthritis) occurs in 18.06 per cent of cases of scarlet fever. In the presence of arthritis it appears in 27.2 per cent of cases of scarlet fever. The attempt to prove a partial co-relationship between adenitis and arthritis by mathematical methods was unsuccessful.

20. Out of 44 cases of endocarditis occurring in scarlet fever, 16 or 36.4 per cent were associated with arthritis. Out of 9 cases of pericarditis occurring in scarlet fever, 7 or 77 per cent showed an associated arthritis. Taken together, out of 61 cases of endocarditis or pericarditis or both, 26 or 42.6 per cent are associated with arthritis. These cardiac complications appeared in 24,012 cases of scarlet fever, a percentage of 0.25, endocarditis accounting for 0.22 per cent. In scarlet fever showing no arthritis, cardiac complications occurred in 0.15 per cent., and in scarlet fever complicated by arthritis cardiac complications occur in 2.87 per cent.
21. In 702 cases of the septic type of scarlet fever, arthritis occurs as a complication in 8.54 per cent of the cases, the percentage in 458 male cases being 5.02, and in 244 female cases, 15.16.
22. In 207 cases of relapsed scarlet fever, arthritis occurred in 4.35 per cent of cases. In 119 male relapsed cases it occurred in 5.04 per cent, and in 88 similar cases in females it occurred in 3.41 per cent.
23. The amount of arthritis is proportionate to the amount/



amount of scarlet fever throughout the year, except during the months of April and May, when the amount of arthritis appears to increase, while the amount of scarlet fever is decreasing. The highest percentage incidence occurs in July, namely 4.87 per cent, and the lowest in February and August, namely 1.80 per cent and 1.85 per cent respectively. During the months December, January and February, the incidence is definitely below the average.

24. In the opinion of the writer, scarlatinal arthritis deserves to be considered a clinical entity separate from true acute rheumatic polyarthritis, on account of the differences in the age and sex incidence, in the joints attacked, in the severity of the inflammatory process, in the comparative infrequency of heart complications, in its behaviour to salicylates, and on account of the constancy in time of appearance of the complication in the course of the fever.
25. In the opinion of the writer the aetiological factor in scarlatinal arthritis is either (a) a streptococcus or its toxin, or (b) an anaphylactic manifestation.

In conclusion the writer would express his deepest thanks to Dr C.B. Ker for putting the records of the Edinburgh City Hospital so completely at his disposal and for his never failing interest and encouragement in this, as in all activities connected with the subject of infectious fevers. The writer is also indebted to Lieutenant-Colonel McKendrick of the Royal College of Physicians laboratory for advice regarding the mathematical method of arriving at a partial correlation. To the nursing staff of the city hospital the writer is deeply grateful for their ready assistance with patients.

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