

THE ETIOLOGY OF DISORDERED ACTION OF THE HEART.

A REPORT ON 7,803 CASES.

BY

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This paper is an attempt to analyse and draw some conclusion from the study of 7,803 cases admitted as disordered action of the heart (D.A.H.) or valvular disease of the heart (V.D.H.) to No. 1 Convalescent Dépôt. It covers a period of exactly two years (November 16th, 1916, to November 16th, 1918). This was the first heart centre to be started in France. To Colonel Hume is due the credit of inaugurating this centre and the others which subsequently were established at other bases.

A large amount of work has been done on the so-called D.A.H. cases and a great deal written about them. Colonel Hume published a paper on 1,000 cases and dealt fully with many aspects, which it will be unnecessary to deal with further. The study of a larger number and extending over a long period, however, enables me to bring out certain points which it was impossible to make with a smaller number, and it is these points that I have attempted to elucidate further.

One of the main objects of this analysis is an effort to form some sort of opinion on the apparent causes of D.A.H. As the figures cover a period of two years I have for convenience divided them into four periods of six months. This has the advantage also of showing how the conditions of warfare altered during the two years owing to the use of gas, the increase of trench fever, and the effect of strain on the individual.

Not the least important part of the work was the first sifting of the cases. A careful examination was made on admission of all cases sent as D.A.H. or V.D.H., and where necessary the alteration of diagnosis was made, and cases of "other disease" were transferred to other medical divisions. The following tables show the results divided into the four periods of six months.

TABLE I.—Diagnosis sent in 7,803 Cases, showing Number and Percentage for Each Period of Six Months.

	First 6 mths.		Second 6 mths.		Third 6 mths.		Fourth 6 mths.		Total.	
	No.	P.c.	No.	P.c.	No.	P.c.	No.	P.c.	No.	P.c.
D.A.H....	1274	81.1	1784	92.9	1891	91.4	2019	90.0	6968	89.2
V.D.H....	297	18.9	137	7.1	179	8.6	222	10.0	835	10.8
	1571	100	1921	100	2070	100	2241	100	7803	100

TABLE II.—Actual Diagnosis in 7,803 Cases.

	First 6 mths.		Second 6 mths.		Third 6 mths.		Fourth 6 mths.		Total.	
	No.	P.c.	No.	P.c.	No.	P.c.	No.	P.c.	No.	P.c.
D.A.H....	1212	77.1	1637	87.8	1765	85.0	1951	87.0	6615	84.7
V.D.H....	91	5.8	72	3.8	72	3.5	69	3.0	304	3.8
Other diseases	268	17.1	162	8.4	233	11.5	221	10.0	884	11.5
	1571	100	1921	100	2070	100	2241	100	7803	100

Tables I and II show a very large error in the diagnosis of the organic lesions. There were 835—that is, 10.8 per cent.—admitted as V.D.H.; but on examination this number was reduced to 304—that is, 3.8 per cent. The error is in fact larger than this, as many of the actual organic lesions had been diagnosed as D.A.H., for out of the total of 304 cases admitted as V.D.H. there were only 182 cases in reality, yet, as the total number of V.D.H. was 304, it shows that 122 had been wrongly diagnosed as D.A.H. The following table shows this error.

TABLE III.—Diagnosis sent in the 304 Cases of Actual V.D.H.

	First 6 mths.		Second 6 mths.		Third 6 mths.		Fourth 6 mths.		Total.	
	No.	P.c.	No.	P.c.	No.	P.c.	No.	P.c.	No.	P.c.
V.D.H....	54	59.3	49	68.0	23	32.0	46	33.3	172	56.5
D.A.H....	37	40.7	23	32.0	49	68.0	23	66.6	132	43.5
	91	100	72	100	72	100	69	100	304	100

Table III shows that out of a total of 304 cases of V.D.H. 132 of them had been diagnosed as D.A.H.; that is to say, nearly half of them had been missed.

These errors in diagnosis are important, not so much, perhaps, because early lesions were missed, but in correcting the wrong diagnosis of V.D.H., for when once diagnosed as such the case is passed from one hospital to another, no medical officer taking upon himself the responsibility of altering the diagnosis. Further, the patient learns what its diagnosis is, and it becomes a matter of the greatest difficulty to persuade him that he is suffering from no such thing.

TABLE IV.—"V.D.H." and Rheumatic Fever.

	No.	Rh. F.	No Rh. F.
Mitral regurgitation ...	91	53	38
Mitral stenosis ...	88	55	33
Mitral regurgitation and stenosis ...	26	18	8
Aortic regurgitation ...	59	24	35
Aortic regurgitation and mitral stenosis	24	16	8
Aortic stenosis ...	1	1	0
Total ...	289	167 (57.8%)	122 (42.2%)

Of 289 cases of valvular disease, 57.8 per cent. gave a history of rheumatic fever; the criterion of this was a history of swollen joints and confinement to bed for at least four weeks. In addition there were 10 men with paroxysmal tachycardia, none of whom gave a history of rheumatic fever, 4 cases of congenital defects of the heart, and one case of infective endocarditis.

A large number of the cases of organic lesions had stood many months of hardship and strain in the front line. Of the 304 cases, 181 complained of symptoms before enlistment, and 123 had none until after varying periods of service.

TABLE V.—Onset of Symptoms.

	First 6 months.		Second 6 months.		Third 6 months.		Fourth 6 months.	
	No.	Per cent.	No.	Per cent.	No.	Per cent.	No.	Per cent.
Before enlistment ...	762	58.5	797	45.3	708	38.5	624	30.9
After enlistment ...	541	41.5	962	54.7	1,129	61.5	1,396	69.1

Table V shows that there was a marked decrease in each successive six months in the number who gave a history of symptoms in civil life, with a corresponding marked increase of those who developed them after enlistment. This may be attributed partly to the effect of the strain of active service, and partly to the fact that those enlisting during the last two years were of an inferior constitution and so broke down sooner under the conditions of warfare.

Causation.

To attempt to ascertain the main causes instrumental in bringing about the symptoms of D.A.H. is one of the chief objects of this analysis. D.A.H. is not a clinical entity, and the factors which go to produce the symptoms are numerous. Of necessity this cannot be an accurate analysis, as we had to be guided largely by the history given by the patient. Further, it was difficult, and in

some cases impossible, to know to which of several factors the symptoms should be ascribed. For instance, a man after a considerable time in the front line might get a dose of gas which incapacitated him for a day or two only, and might afterwards develop persistent symptoms of D.A.H. The question arises, Are those symptoms due to strain, both physical and mental, the gas being merely the last straw, affecting possibly his mental state rather than his physical condition, or is the gas solely to be blamed?

I have taken the view in such cases that the gas is merely the last incident and is not the real factor, just as in the case of a man being "blown up" by a shell bursting near and symptoms of neurosis following, the being "blown up" is merely the last straw; it is the previous mental struggle and strain which are the real causes.

TABLE VI.—*Causation.*

	First 6 months.		Second 6 months.		Third 6 months.		Fourth 6 months.	
	No.	Per cent.	No.	Per cent.	No.	Per cent.	No.	Per cent.
Infection before enlistment	210	20.8	263	22.4	230	20.3	246	22.4
Infection after enlistment	42		115		128		191	
Neurosis before enlistment	165	13.6	141	8.4	93	5.2	99	5.1
Strain after enlistment	237	19.6	418	24.8	638	36.2	625	32.1
Civil occupation	48	3.9	58	3.4	22	1.2	8	0.4
Constitution	148	12.2	187	11.1	190	10.8	188	9.6
Gas	11	0.9	79	4.7	111	6.3	207	10.6
Age	12	1.0	41	2.4	49	2.8	75	3.8
Various	5	0.6	12	0.7	7	0.4	5	0.3
Unknown	334	27.4	373	22.1	297	16.8	306	15.7
Totals	1,212	100.0	1,687	100.0	1,765	100.0	1,951	100.0

In Table VI I have tabulated the apparent causes under nine headings. Those coming under the heading of "unknown" are unavoidably large, but it would have been mere guessing to attempt to classify these cases accurately; in many of them one could find no attributable cause, and in others there were so many possible factors that it was useless to classify them otherwise.

Undoubtedly the greatest factor in the production of symptoms of D.A.H. is the physical and mental strain of war. It accounts for 19.6 per cent. in the first of the six months and as large a percentage as 36.2 in the third six months. It was impossible in many cases to distinguish whether the strain was chiefly mental or physical, the symptoms produced being identical; I have therefore included the two together under the heading of "Strain after enlistment." That is to say, those under this heading showed no symptoms in civil life, but eventually broke down under the stress of training or active service. The effects of this were clearly shown by the large number of admissions after the German push towards Amiens in March and April, 1918.

Infections.

Infections come easily second as a cause, varying in each period of six months very slightly—namely, from 20.3 per cent. to 22.4 per cent.—and by far the greater number of these were due to infections in civil life and not to P.U.O., as has been widely held.

Table VII shows that the most crippling infection and that producing permanent disability of varying degrees is rheumatic fever. It accounts for from 40.7 per cent. up to 56.7 per cent. of the total cases of infection.

It has been asserted that trench fever accounts for over 50 per cent. of all D.A.H. cases. This was found to be far from the case. Infections account for about 21 per cent. of all cases, and of the infections P.U.O. (pyrexia of unknown origin) accounts for from 6.4 per cent. in the first six months up to 23.2 per cent. in the last period.

TABLE VII.—*Varieties of Infection causing D.A.H.*

	First 6 months.		Second 6 months.		Third 6 months.		Fourth 6 months.	
	No.	Per cent.	No.	Per cent.	No.	Per cent.	No.	Per cent.
Rheumatic fever	143	56.7	188	49.7	193	53.9	178	40.7
P.U.O.	16	6.4	62	16.4	68	19.0	101	23.2
Pneumonia	26	10.3	38	10.0	23	6.4	34	7.8
Scarlet fever	15	5.9	11	2.9	0	0	10	2.2
Enteric	14	5.5	10	2.6	18	5.0	21	4.9
Dysentery	10	3.9	17	4.5	11	3.0	12	2.7
Diphtheria	7	2.8	7	1.8	7	1.9	17	3.8
Malaria	4	1.5	16	4.3	17	4.8	31	7.1
Pleurisy	3	1.3	6	1.6	6	1.7	7	1.6
Bronchitis	2	0.8	19	5.1	10	2.8	21	4.9
Measles	2	0.8	—	—	—	—	—	—
Jaundice	2	0.8	—	—	—	—	—	—
Various	8	3.2	4	1.1	5	1.5	5	1.1
Totals	252	100.0	378	100.0	358	100.0	437	100.0

The following particulars of the discharge of D.A.H. cases following rheumatic fever and P.U.O. respectively throw some light on the severity of the disability following each.

In 798 cases following rheumatic fever 560 were admitted as A men. Of these, 175, or 31.2 per cent., were discharged A, and 79, or 14.1 per cent., were evacuated to England.

Of 238 admitted as B men, 60, or 25.2 per cent., were discharged to England.

Comparing this with the discharges in 422 cases following P.U.O., there were 354 admitted as A men, and of these, 211, or 58.0 per cent., were discharged as A men, and only 16, or 4.3 per cent., evacuated to England.

Of 58 admitted as B men only one man was evacuated to England.

From these figures it appears that P.U.O., which includes all the cases of trench fever, is not a very serious factor in the production of D.A.H., nor does it produce D.A.H. of great or lasting severity.

Pneumonia was the infection which produced the next largest numbers, varying from 6.4 per cent. to 10.3 per cent. of the total infections. Scarlet fever, enteric, dysentery, diphtheria, and malaria caused about the same number.

Neurosis before Enlistment.

Under this heading I have included those men who gave a history of nervous instability in civil life. "Nervous breakdown" was a frequent symptom. This heading accounts for from 5.1 per cent. to 13.6 per cent.

Civil Occupation.

This apparently was not a very important factor. Bakers frequently complained of symptoms of D.A.H. in civil life. From 0.4 per cent. to 3.9 per cent. of cases were accounted for in this way.

Constitution.

From 9.6 per cent. to 12.2 per cent. were accounted for in this group; it includes those who were undeveloped, weakly, and those who from boyhood had been incapable of severe physical exertion.

Gas.

This increased each period of six months, from 0.9 per cent. to 10.6 per cent. In 1917 Colonel Hume published a report on 33 of the cases of severe mustard gas poisoning. His conclusions were that as the symptoms were neither marked nor persistent it seemed unjustifiable to assert that any of them presented a true picture of D.A.H.; that the symptoms of which the patients complained during convalescence seemed to be sufficiently accounted for by the injury done to the lung, by the fever, and by the rather prolonged period in bed; and that there seemed no evidence that the heart was in any way affected save through the increased excitability of the sympathetic nervous system.

In April, 1918, another batch of 16 severe cases of mustard gas poisoning were admitted. These were sent by Captain Barber, R.A.M.C., No. 25 General Hospital; only one had to be evacuated to England owing to symptoms referable to the heart. This man was fit previous to being gassed. On admission he was very short of breath, and had a markedly dilated heart, the apex beat being 4½ in. from mid sternum with a short apical systolic murmur. The remainder returned to duty without any symptoms of D.A.H.

Table VIII shows how 318 gas poisoning cases were discharged. Only 8 of them were evacuated to England, and 61.1 per cent. of the A men were discharged as A. How these gas cases were discharged is a good indication as to the permanence of their D.A.H. symptoms, especially if the following table be compared with the discharges from other causes in Table IX.

TABLE VIII.—Discharge of 318 Gas Cases.

Category.	How Discharged.
A 293	A 179 = 61.1% B 62 = 21.2% Hospital 20 England 8 Other dépôt 24 } = 17.7%
B 23	B 21 = 91.3% Other dépôt 2 = 8.7%
Unknown ... 2	Discharged A... .. 1 Discharged B... .. 1
Total ... 318	318

I think, therefore, we may conclude that though gas produces during convalescence symptoms of the same nature as D.A.H., yet that these symptoms are neither serious nor lasting.

Age and various diseases other than those mentioned are the cause of a small percentage.

Lastly, those to whom it was impossible to attribute a definite cause accounted for from 15.7 to 27.4 per cent. This seems a large number, but in order to obtain figures of any value in working out the causation this could not be avoided.

CONCLUSION.

In conclusion, I would state that the strain, mental and physical, of warfare is the chief cause of the symptoms of D.A.H. That the causation of next importance is infective diseases, and of these the majority was due to those contracted in civil life, rheumatic fever being the worst offender.

Table IX shows how 6,269 cases of D.A.H. were discharged, and for comparison I have added a table giving the discharge of 790 cases which were due to rheumatic fever and 422 cases following P.U.O.

TABLE IX.

Discharge of 6,269 D.A.H. Cases.

Admitted as A men	4,991 cases.
Discharged as A men	48.0 per cent.
Discharged as B men	39.1 "
Discharged to hospital, O.C.D., England	12.9 "
Admitted as B men	1,278 cases.
Discharged as B men	89.0 per cent.
Discharged to hospital, O.C.D., England	11.0 "

Discharge of 790 Cases of Rheumatic Fever.

Admitted as A men	560 cases.
Discharged as A men	31.2 per cent.
Discharged as B men	44.5 "
Discharged to hospital, O.C.D., England	24.3 "
Admitted as B men	230 cases.
Discharged as B men	69.8 per cent.
Discharged to hospital, O.C.D., England	30.2 "

Discharge of 422 Cases of P.U.O.

Admitted as A men	364 cases.
Discharged as A men	58.0 per cent.
Discharged as B men	17.6 "
Discharged to hospital, O.C.D., England	24.4 "
Admitted as B men	58 cases.
Discharged as B men	86.2 per cent.
Discharged to hospital, O.C.D., England	13.8 "

My thanks are due to Colonel W. E. Hume, C.M.G., A.M.S., for permission to use the records from which the above figures are taken, and also to Lance-Corporal Dillingham, R.A.M.C., whose assistance in extracting the figures was invaluable.

THE PATHOLOGY AND TREATMENT OF STIFF KNEE IN RELATION TO COMPOUND FRACTURE OF THE FEMUR.

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FIBROUS or bony ankylosis of the knee frequently follows compound fracture of the femur when the fracture is into the joint or when there has been prolonged suppuration near the joint.

There is, however, another class of "stiff knee" which follows compound fracture of the shaft of the femur in which the limitation of flexion is not due to articular so much as periarticular and muscular changes. This is the type which yields very satisfactory results with careful treatment, but is frequently dealt with in a very offhand sort of way, leading often to disastrous results. Stiff knee after compound fracture of the femur may be due to articular, periarticular, or muscular causes.

It is chiefly the changes in the quadriceps which concern us at the moment, and before we discuss the treatment it is useful to glance at the pathology of these, as our methods must be guided largely by it. We should keep it in mind that some degree of joint infection must occur in all cases of compound fracture, although in those we are considering the reaction of the joint tissues is generally sufficient to deal with this. The real obstruction to flexion is to be looked for in the very profound alteration occurring in the quadriceps as a result of sepsis and prolonged disuse.

In a typical example we find a markedly wasted and scaphoid quadriceps. On attempting passive flexion of the knee considerable pain is generally caused on account of periarticular adhesions, but if these are absent a very much shortened quadriceps prevents flexion for more than a few degrees. This means that the normal functions of extensibility and contractibility are absent; that in parts dense scar has replaced the muscle tissue; and that there are scars of healed sinuses reaching down to bone. This state of affairs has resulted from the original injury, the persistence of sepsis, and prolonged disuse.

Histologically the picture varies with the position from which the sections are taken. Those near the septic focus show absolute replacement of muscular tissue by scar, while other sections show decreasing amounts of scar as we get further from the site of injury.

Throughout the muscle, even in that portion most distant from the injury, there is considerable shortening of individual muscle fibres, which, in addition to showing marked contraction in size, are in a state of partial degeneration, and as a result of prolonged disuse have "forgotten" how to function. Their condition is in fact that of typical disuse-atrophy.

It is a well established pathological fact that cells in this state tend to be replaced by fibrous tissue, and this does occur to some extent just as in the same way such structures as the ductus arteriosus and thymus, when they cease to function, are gradually replaced by fibrous tissue.

But not only is the muscle substance shortened and partially replaced by scar; the individual fibres are surrounded by lymph spaces which drain into lymph capillaries, and it must be remembered that lymph is coagulable in virtue of the fact that it contains fibrinogen and its cellular elements thrombin. Coagulation will follow any of those incidents which cause clotting of the blood; among these are trauma, contact with harmful nucleo-proteins manufactured in the septic focus, and stasis. Nature attempts to remove this clot by phagocytosis, but as a result of the special conditions we are considering a certain amount of scar tissue remains, gluing the fibres together and forming intramuscular adhesions.

In opposition to the changes above enumerated there is a certain degree of regeneration going on as a result of