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THE QUINIDINE TREATMENT OF AURICULAR FIBRILLATION[1]

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Six years ago Parkinson and Campbell (18) reported a series of forty-four cases of auricular fibrillation which had been treated with quinidine, and reached the following conclusions. 'When established fibrillation is of recent onset, quinidine is the treatment of choice and should be used at once. In the absence of serious congestive failure, or much cardiac enlargement, it is likely to give even better results than digitalis, often restoring normal rhythm for some years with remarkable freedom from symptoms. When, on the other hand, fibrillation has lasted for six months, when there is a large heart or gross congestive failure, digitalis is the best treatment and quinidine should rarely be used, because of the risk, and because of the smaller chance of any lasting success.'

It seemed worth following up these patients after six years to decide where quinidine is of lasting value. We have traced all those where normal rhythm was maintained, up to December 1934, or for at least five years after its restoration; and in the less successful cases until fibrillation returned. The first section deals with the after-histories in these 44 patients. The second reports our experience with 91 patients during 1929–34, and the third the results of the two series in those with goitre where the problems involved are rather different. In the fourth section the after-treatment is discussed, and in the fifth the importance of the size of the heart.

We are greatly indebted to Dr. John Parkinson for giving us facilities in following up those of his private and hospital patients, who formed the greater part of the first series, and for much other help.

I. *After-histories of 44 Patients treated with Quinidine up to 1928*

This follow-up confirms the value of quinidine provided there has been careful selection. Normal rhythm was restored in 30 of the 44; in 11 it is still maintained after an average period of nine years. Some have had one or two short relapses when fibrillation was again arrested with quinidine. In the 19 who no longer have normal rhythm the treatment was of value as the average period of maintenance was 34 months.

[1] Received October 10, 1935.

TABLE I

The Influence of Aetiology on the Result of Treatment (First Series)

	Mitral stenosis or a history of rheumatic fever.	Goitre.	Other conditions.
Normal rhythm still maintained after from 7 to 11 years	2*	3	6
Normal rhythm restored, sometimes for 4 or 5 years, but not maintained	12	2	5
Normal rhythm not restored	10	1	3

* No evidence of mitral stenosis in these two.

In Table I the cases have been grouped according to aetiology, and the second conclusion from this longer survey is that the presence of rheumatic valvular disease is even more important than appeared. Only three patients with mitral stenosis maintained normal rhythm for 4 years, and the two in the rheumatic group who maintained normal rhythm for 7 and 8 years (Cases XXVIII and XXIX,[2] had no valvular disease and were included because of a rheumatic history. The three strikingly successful cases of the goitre group (Cases XXX, XXXI, and XXXII), with normal rhythm maintained for 11, 10, and 8 years, had then little if any evidence of active hyperthyroidism, and did well without operation. Six cases belonging to the remaining group maintained normal rhythm for 9 years.

TABLE II

The Influence of the Duration of Fibrillation before Treatment on the Result Obtained (First Series)

	Duration of fibrillation before treatment.		
	One month or less.	More than one, but less than six months.	More than six months.
Normal rhythm still maintained after more than seven years	6	4	1
Normal rhythm restored, sometimes for four years, but not still maintained	6	9	4
Normal rhythm not restored	1	6	7

The average duration of normal rhythm, taking all cases whether fibrillation has returned or not, was 41 months in the rheumatic, 86 months in the goitre, and 77 months in the remaining group.

The duration of fibrillation before treatment is important in estimating the probability of success, and Table II shows the results when the patients are followed for several years. Normal rhythm is still maintained in 6 out of 13 patients where fibrillation had lasted less than a month, but in only 1 out of 12, where it had lasted more than six months.

[2] Case notes of these 44 patients have already been published with the same Roman numerals (18). The cases of the second series are denoted by Arabic numerals.

Short notes of the 11 cases which still maintain normal rhythm follow. In these abstracts M. 48. stands for male, aged 48; N.R. for normal rhythm; Q. for quinidine. The first paragraph describes, briefly, their condition before the first treatment with quinidine; rather more detailed notes of their condition up to June 1928 have been published (18).

Case XXVIII. M. 22. Rheumatism at 12; heart slightly, if at all, enlarged, no mitral stenosis.

N.R. restored 1926. Took 5 gr. Q., b.i.d., for one year and once a day for a second year. Relapsed after eight years.

N.R. restored with 15 gr. Q. (the same dose as before) and has been maintained for six months. (Dec. 1934).

Case XXIX. M. 58. Rheumatic fever at 12; heart slightly enlarged, no mitral stenosis.

N.R. restored 1926 and maintained after 92 months, Q. being taken for six months only. (Feb. 1934).

Case XXX. M. 54. Small thyroid cyst, no hyperthyroidism; heart slightly enlarged.

N.R. restored 1923. Relapsed after 4 years, five weeks after stopping Q.

N.R. restored with 20 gr. Q. (the same dose as before) and still maintained after 138 months in all, still taking Q. regularly, 5 gr. daily. (Letter from doctor, Jan. 1935).

Case XXXI. F. 52. Five years before exophthalmic goitre which was almost cured; heart slightly enlarged.

N.R. restored 1923. Took Q. for 18 months. N.R. still maintained without further Q. after 124 months. (Dec. 1934).

Case XXXII. M. 49. Large goitre for many years, no hyperthyroidism, B.M.R. normal; heart moderately enlarged.

N.R. restored 1927. Relapse after 28 months when 6 months without Q. Relapse again in fourth year when taking Q. less regularly.

N.R. restored and still maintained after 93 months, generally with 5 gr. Q. twice daily. (Dec. 1934); after 102 months (Sept. 1935).

Case XXXIII. M. 37. Heart not enlarged, no apparent disease.

N.R. restored 1923. Took 5 gr. Q. twice daily for two years and then once a day. Relapsed twice in the tenth and eleventh years when he had been some months without quinidine. N.R. still maintained with Q, 5 gr. daily, after 140 months. (Dec. 1934).

Case XXXIV. M. 36. Heart slightly enlarged, no apparent disease.

N.R. restored 1925. First relapse after three years when 18 months without Q., this having been reduced gradually to 5 gr. once a day. Second relapse three months later when shut in the self-closing doors of the 'Tube'.

N.R. again restored and still maintained after 119 months, without Q. for the last six years. (Sept. 1935).

Case XXXVI. M. 22. Heart slightly enlarged, no apparent disease.

N.R. restored 1924. Took Q. for one month only. Has remained quite fit since in every way for over ten years except for one short relapse. (Letter from doctor, March 1935).

Case XXXVII. F. 52. Heart not enlarged; B.P. 160/75 rising to 190/90 two years later.

N.R. restored 1926 and took Q. for two and a half years, 5 gr. t.i.d. for one year and then b.i.d. N.R. maintained after 101 months, but a little short of breath and B.P. had increased to 220/115. (Nov. 1934).

Case XXXVIII. M. 55. Heart not enlarged; no apparent disease.

N.R. restored 1927. Took Q. 5 gr. b.i.d. for 6 months and then once daily for one or two years. N.R. maintained and in good health after 92 months. (Letter from doctor, Feb. 1935).

Case XXXIX. M. 55. Heart not enlarged; no apparent disease.

N.R. restored 1927, and maintained after 95 months. But he still has paroxysms of fibrillation and finds these shorter and less frequent if he continues to take 5 gr. Q. twice daily. (Feb. 1935).

II. *Results Obtained in the Second Series*

Selection of cases. These 91 cases of auricular fibrillation included all which we treated with quinidine during the six years 1929–34. Owing to the favourable impression made by the first series the selection of the second series was less rigorous, but generally there was no gross congestive failure or great enlargement of the heart, and fibrillation had been present for less than six months.

All the 40 patients in the rheumatic group had mitral stenosis, except 2 who had aortic incompetence alone; 3 had both lesions. The 10 with goitre are discussed later. There were 32 where fibrillation was due to other causes; 9 had high blood-pressure, and 10 were elderly patients with fairly large hearts and arteriosclerosis. The remaining 13 showed little, if any, evidence of heart disease except the arrhythmia, and generally the heart was only slightly enlarged. In 4 the maximum transverse diameter of the heart was over 13·0 cm., and they were considered as having myocardial disease of unknown origin; but in 9 it averaged 11·8 cm. and was not enlarged, as many of them were big, well-developed men. Treatment was satisfactory in this group.

Mode of administration of quinidine. The same method of treatment was nearly always adopted. Before quinidine was used congestive heart failure was treated and the ventricular rate controlled with rest and digitalis. Digitalis was then omitted and quinidine sulphate was given, the times of administration and the dosage being as shown below.

1st day.	Quinidine	gr. v. as a test dose.
2nd ,,	,,	,, ,, at 6 and 8 a.m.
3rd ,,	,,	,, ,, ,, 6, 8, and 10 a.m.
4th ,,	,,	,, ,, ,, 6, 8, 10 a.m., and 12 noon.
5th ,,	,,	,, x ,, 6, gr. v. at 8, gr. x. at 10 a.m.
6th ,,	,,	,, ,, ,, 6, 8, and 10 a.m.

The treatment given on the sixth day was usually repeated for three days if normal rhythm was not restored, and this daily dose was rarely exceeded. This gradual increase in dosage tends to give warning of any toxic symptoms before they are serious. The short interval between doses is advisable because of the rapid elimination of quinidine from the blood stream (25).

Patients were kept strictly confined to bed during treatment and for three days after normal rhythm was restored. A close watch was kept on the heart rate and instructions were always given for quinidine to be discontinued if any untoward symptoms arose. Weisman has reported 17 of 24 patients successfully treated by the ambulatory method, although they did not appear specially favourable cases (24), but we have not thought it wise to use this method except occasionally for a relapse in a patient who had not got mitral stenosis.

Digitalis was used simultaneously with quinidine in three patients. All had had a previous course of quinidine, and in two no better result was obtained by the combination. But in one (Case 5) normal rhythm was restored with 15 grains of quinidine while she was taking 15 minims of tincture of digitalis three times a day, although previously two full courses of quinidine had failed: she relapsed six months later when she went on a pilgrimage to Lourdes without quinidine, but on her return normal rhythm was restored without digitalis.

TABLE III

Daily Quantity of Quinidine needed for Restoration of Normal Rhythm

Amount of quinidine	5 gr.	10 gr.	15 gr.	20 gr.	25 gr.	30 gr.	35 gr.
Number of cases	2	19	25	24	11	27	2

Table III shows the amount of quinidine given on the day when normal rhythm was restored (both series combined). The number of successes was fairly equally distributed. The amount needed when treatment was repeated after a relapse is of interest, as generally, even after some years, the same effect followed the same dose of quinidine. In 14 cases normal rhythm was restored a second time by exactly the same amount; in 7 cases by 5 grains more or less; and in another 5 cases by 10 grains more or less. Only in one case without an obvious cause, such as partial thyroidectomy or a great increase in the size of the heart, was there a greater discrepancy than this. In 3 cases exactly the same amount of quinidine restored normal rhythm after an interval of more than five years. As a contrast, Case 47 recovered normal rhythm with 15 grains, but four years later, when her heart was much larger, failed to do so with 30 grains. This patient showed the importance of adequate rest and digitalization, a point which has been stressed by Wolff and White (27). On her first admission two full courses failed, but after another month's rest, with regular digitalis, 15 grains of quinidine restored normal rhythm. Failure to achieve success is often due to trying to get the result too quickly, and if any signs of failure have been present prolonged rest and treatment in bed is a necessary preliminary.

Another point which we think of great importance is that the patient should be free from any infection, even of the most trivial nature, at the time of treatment with quinidine (see page 213).

TABLE IV

The Influence of Aetiology on the Result of Treatment (Second Series)

	Mitral stenosis or a history of rheumatic fever.	Goitre.	Other conditions.
Normal rhythm restored and still maintained	7	16	12
Normal rhythm restored but not maintained	15	0	6
Normal rhythm not restored	18	3	14

Results of treatment. Quinidine restored normal rhythm in 56 cases (62 per cent.), but failed to do so in 35, including 7 in whom the duration of restored rhythm was too short to be of any practical use. The results are summarized in Table IV, and an abstract of the clinical notes and results in each case is given in Tables VIII–XV.

The duration of fibrillation before treatment influenced the chance of success (see Table V). Where it had been present for a month or less normal rhythm was regained in 80 per cent. and maintained in 47 per cent.; where it had been present for more than six months, in 53 and 6 per cent. Cases with goitre have not been included here or in Table VI, because the possibility of operation makes the previous duration of fibrillation, and even the size of the heart, less important. Of the 16 successful cases with goitre, fibrillation had been present for more than six months in half, and for less than one month in only a quarter, but in spite of this the results were excellent.

TABLE V

The Influence of the Duration of Fibrillation before Treatment on the Result Obtained (Second Series) *

	Duration of fibrillation before treatment.		
	One month or less.	One to six months.	More than six months.
Normal rhythm restored and still maintained	7	11	1
Normal rhythm restored but not maintained	5	9	7
Normal rhythm not restored	3	22	7

* These figures do not include the cases with goitre.

Normal rhythm is still maintained in 35 cases, 7 with rheumatic heart disease, 16 with goitre, and 12 with fibrillation due to other causes (Table IV). The goitre group will be discussed separately (see p. 214). In the other two groups the average duration of fibrillation before treatment was less than three months. The average heart size was 12·5 cm. in 15 of the 19 where it was measured. In 10 cases normal rhythm has as yet been maintained for

less than two years; in 4, for two or three years; and in 5 for over four years; the average being nearly two and a half years.

Three of the rheumatic cases and 4 of the others had short temporary relapses, and were again successfully treated with quinidine. As the average duration of restored normal rhythm after these relapses is already more than twenty months, a relapse certainly does not indicate that a second treatment may not be worth while.

Normal rhythm restored but not maintained. In 21 cases normal rhythm was restored, but has not been maintained. In 5, 3 of whom were rheumatic, the duration of restored rhythm was six months or less. The average heart size was 15 cm., and this was probably the cause of the relapse. In 16 cases normal rhythm was maintained for a longer period, the average heart size being smaller (12·4 cm. for 9 cases). The average duration of fibrillation in both subdivisions was just over three months, excluding Cases 53 and 56.

Normal rhythm was maintained for over one year in 7 cases, for over two years in 6, for over three years in 3; the average period being eighteen months. Eight relapsed and were again treated with quinidine. In 5 normal rhythm was not restored, and in the 3 it was restored but not maintained for long, which might suggest that treatment after a relapse was rarely worth while. But among those who still have normal rhythm there were 7 who did well after relapses, so if conditions are favourable, and especially if any reason for the relapse can be found, a second attempt to restore normal rhythm with quinidine should be made.

In two of these cases fibrillation had been present for longer than usual. In Case 53 it had been present for 15 years, but in spite of this it was arrested with 35 grains of quinidine. The proof that it had been present for such a long period is the patient's story of sudden palpitation starting when on his round as a baker and continuing without intermission afterwards, and an electrocardiogram, taken three years after the start, showing fibrillation. It is of course possible that fibrillation and normal rhythm alternated without his being aware of the change, but he had readily appreciated the sudden onset and there was no spontaneous change while he was under observation. In spite of this long period of fibrillation there was no enlargement of his heart (confirmed by X-ray), no other evidence of heart disease, and no symptoms except palpitation. He relapsed after two months, and as on a second occasion 30 grains of quinidine induced a paroxysm of tachycardia or flutter (ventricular rate 180, but no electrocardiogram) it was thought wiser to continue his treatment with digitalis.

Normal rhythm not restored. Quinidine did not succeed in 28 patients, and in another 7 normal rhythm was restored for such a short time that it was of no practical use. These 35 failures would be valuable if they enabled us to reach greater certainty as to which were unsuitable for quinidine. The reason was not because fibrillation had been present for too long, for the average duration was 3·7 months, excluding three in whom the period was more than two years.

We believe that one reason for the failure was that their hearts were larger, the average maximum transverse diameter being 14 cm. in the 27 in whom it was measured by orthodiagram, compared with 12·5 cm. in those who still maintain normal rhythm. High blood-pressure was another factor militating against success, as it was present in 6 of these, but in very few others. In 18 of the 35, the heart was larger than the standards for success laid down as the result of this study, the transverse diameter averaging 15·3 cm. Several of those with the largest hearts (e.g. Cases 59, 84, and 91, with hearts 17 cm. or over) were selected for quinidine treatment because they had been relatively free from symptoms until the onset of fibrillation. Evidently this reason is inadequate.

In 17 all the conditions seemed favourable, and the maximum transverse diameter of the heart averaged 12·6 cm. In 8 of these, most of whom had two full courses after adequate preparation, there were no special symptoms, but fibrillation continued. In 5 there were symptoms of intolerance, headaches, nausea, sweating, or palpitation, often with a rise of ventricular rate to 130, when they had reached the full dose. In 2 there were immediate relapses in spite of continuing quinidine, in another temporary flutter, and in another a mesenteric embolism (see later). This was the only serious complication in a patient whose heart was not much enlarged.

In the 18 whose hearts were larger (average transverse diameter 15·3 cm.) 10 had no particular symptoms, but fibrillation continued, generally after two full courses. There was a rise of temperature which seemed to be due to quinidine in three patients, although there were no other signs of active infection: to 102° F. with sweating and vomiting in Case 60; to 101° F. with both courses of quinidine in Case 71, and to 100° F. with general malaise during both courses in Case 87. An occasional rise of temperature during treatment might be a coincidence, but when it happened five times it was probably in some way due to the quinidine.

In Cases 69 and 83 quinidine was stopped because the electrocardiogram showed widening of the QRS complexes after 25 and 30 grains, although neither complained of any special symptoms; many other electrocardiograms were taken in patients under treatment without showing similar changes. Of interest in this connexion is the fact that quinidine caused temporary heart block with dropped beats at the time of the return of normal rhythm in the successful Case 23, of which the details have been previously reported (3), and in several cases some inversion or flattening of the T-waves. All these changes have been recorded by others (14).

The 3 remaining cases were among the most serious we encountered. In Case 70 flutter developed after 5 grains of quinidine, and the patient was dangerously ill, vomiting large amounts of frothy blood-stained fluid; she was given digitalis and was almost well in two days (cf. Case 51). Quinidine was given three weeks after her admission with a sore throat and a temperature of 101° F., and probably she had active rheumatic carditis; it would not have been given had this diagnosis been made at the time. Case 81 had

hemiplegia (see section on embolism). Case 74 was the only tragedy; after 30 grains of quinidine the heart was regular and the patient felt well; early next morning she seemed all right, but an hour later she was found dead in bed. The autopsy showed extreme mitral stenosis and no evidence of embolism, so presumably she died from ventricular fibrillation. It is difficult not to incriminate quinidine, though it is generally nearly all excreted again in 4 hours (25), and death took place 17 hours after the last dose. Congestive failure had been present, but quinidine was used because of the excellent response to rest and digitalis.

The presence of infection. In 3 cases an infection initiated auricular fibrillation in a heart that was apparently normal. In a doctor, aged 45 (Case 24), who had been suffering from recurrent boils, fibrillation started when one was opened under an anaesthetic. As the irregularity persisted for two weeks it was thought wiser to arrest it with quinidine; the heart was of normal size and there had been no cardiac symptoms previously. Epidemic influenza was responsible for the onset of fibrillation in Cases 26 and 35, in which there were no other signs of heart disease.

Any active or recent infection made success with quinidine unlikely. In Case 19 the thyroidectomy wound became infected and two full courses of quinidine failed; six weeks after operation, when the wound had healed, normal rhythm was restored. Case 42 developed fibrillation four weeks after admission to hospital with subacute rheumatism; two courses of quinidine were without result, and the temperature had been normal for nine weeks before the third course restored normal rhythm. Quinidine may have failed because the patients had not fully recovered from infections of the nose or throat in Cases 44, 70, and 84.

Infections appeared to precipitate a relapse in 5 other cases. The infections responsible were an alveolar abscess, mumps, a series of bad colds, and in two cases tonsillitis.

The occurrence of embolism. In the first series only two cases developed emboli (18), but in the second series, probably owing to less rigid selection of cases, they occurred five times. In Case 33 an embolism of the femoral artery occurred, but led to no permanent disability; this was the only case with an embolism where normal rhythm was maintained. In Case 43 the irregularity returned after 18 months, and on the second day after normal rhythm had again been restored, emboli of the renal and tibial arteries occurred. Case 48 relapsed after 9 months and a small pulmonary embolism followed the second successful treatment. In Case 50 there may have been a small pulmonary embolism 12 days after the return of normal rhythm, but after another course of quinidine normal rhythm was maintained for 14 months. Case 82 had an embolism of the superior mesenteric artery 8 hours after the return of normal rhythm, and of the radial artery two days later; the patient made a good recovery. Case 81 developed hemiplegia; normal rhythm had been restored for two days, but as the heart had been irregular again for some hours before the attack, it is not certain if the

cause was an embolism or a cerebral thrombosis. All these, except Cases 33 and 81, had mitral stenosis. Case 10 with exophthalmic goitre had a hemiplegia (almost certainly embolic) during the period of fibrillation, but there was no embolism when normal rhythm was restored, and the result has been a most satisfactory one. Although the possibility of an embolism must be borne in mind, it is not a serious risk, and especially in cases with fibrillation and mitral stenosis it is a risk inherent in the condition itself, whether quinidine is used or not.

III. *Patients with Goitre*

The two series have been taken together and 2 cases[3] have been omitted, leaving 23 to be considered. The hyperthyroidism was primary in 8, and secondary to a previous goitre in 15. The heart was generally enlarged, the average size in the twelve where it was measured being 13·3 cm., compared with 12·5 cm. in the successful cases of other groups. The heart was slightly enlarged in 9, moderately enlarged in 8, and greatly enlarged in 2, a much smaller proportion of hearts only slightly enlarged than in the other groups. The average duration of fibrillation before treatment was eight months, and in 3 it was over two years, showing that this is less important than in the other groups.

Normal rhythm is still maintained after restoration with quinidine in 19 cases, and after spontaneous return in one other where quinidine had failed shortly after the operation: only 3 were unsuccessful. The average duration of restored normal rhythm is forty months: in 9 it is as yet less than two years; in 4, two or three years; in 3, four or five years; and in 3, seven to eleven years.

Of the 8 primary cases, 4 with an average basal metabolic rate of +34 per cent. had partial thyroidectomy, and 3 with an average rate of +17 per cent. had no operation. All seven were successfully treated with quinidine: in two fibrillation developed when other symptoms of hyperthyroidism were subsiding, and this no doubt accounted for the success without operation. The eighth refused an operation after quinidine had failed.

Of the 15 secondary cases, 10 had partial thyroidectomy; the basal metabolic rate averaged +32 per cent. Quinidine was successful in 9 and 1 died of pneumonia after operation. In 3 the operation was hemithyroidectomy, but generally it was more extensive. In 1 thyrotoxicosis recurred without the rhythm reverting to fibrillation, and most of the remaining lobe had to be removed. No operation was performed in the other 5; in 4, where the basal metabolic rate averaged +12 per cent. the results were good. The fifth relapsed after two months, but had few symptoms and kept very well with digitalis.

[3] Cases L and LXI were classified as old goitre without hyperthyroidism. In the former the blood-pressure has steadily risen to 250/130, and in the latter it was 180/115; neither have been cured by thyroidectomy and neither have behaved like the other goitre patients.

Almost every case where fibrillation is due to a goitre can be cured unless undue delay has made an operation too dangerous, or allowed permanent myocardial changes to develop. We are reluctant to accept these contra-indications, as it may be the only hope of improvement. Case 19, for example, had been regarded as incurable heart failure ; after operation and restoration of normal rhythm with quinidine, all signs of failure disappeared, and he gained 3 stone in weight. He is doing full work and playing golf, and feels better than he has for years.

Should quinidine be given before operation ? In 4 a full course failed, but after operation normal rhythm was restored easily. In 4 others it was restored before operation. In one digitalis had proved ineffective in controlling the ventricular rate, and the successful use of quinidine diminished the operative risk. Another was greatly improved by normal rhythm, and an operation which had been thought too great a risk was afterwards performed. But in two cases there was a relapse to fibrillation before or during the operation.

Another question is whether quinidine treatment is necessary after partial thyroidectomy, or whether normal rhythm will return spontaneously. Quinidine was given in 9 cases during the second or at the end of the first week, because our impression was that unless normal rhythm returned in the first four days there could be no certainty of its spontaneous return. In one case fibrillation still persisted 8 months after hemithyroidectomy, and in three others after 6, 4, and 4 weeks. But in another where fibrillation had been present for 8 months normal rhythm returned spontaneously 6 days after operation.

Dunhill states that normal rhythm returned spontaneously in 40 per cent. of his patients after thyroidectomy, and with quinidine in another 34 per cent., but does not say how soon the change took place (5). Fraser thinks that fibrillation often stops spontaneously, but that quinidine should be given if it does not in two or three weeks (7). Anderson (1) concludes that 45 per cent. acquire normal rhythm within four days of thyroidectomy—but this is not our experience—another 15 per cent. later, but that 40 per cent. continue to have fibrillation if not treated with quinidine. In his view quinidine should be given at the end of the first week, as success can be anticipated in 90 per cent. of cases then, but less often if treatment is delayed. There seems to be no method of knowing if normal rhythm will return spontaneously, and, as many patients are ready to leave hospital within two or three weeks of partial thyroidectomy, quinidine should be given if fibrillation has not stopped after one or at the most after two weeks.

Little need be said about after-treatment. Quinidine was generally omitted in from 1 to 3 months after operation ; the amount being gradually reduced from 5 grains thrice daily ; sometimes no maintenance dose was given after the return of normal rhythm. As no relapses took place, even in patients who had been treated for a time with small doses of thyroid for increasing weight and hypothyroidism, it would probably be safe to

omit all after-treatment. But it is sometimes advisable if partial thyroidectomy has not been necessary. In 7 of the 8 cases where quinidine restored normal rhythm without operation, the results were good. Case XXXI had kept in good health for 10 years without quinidine. Four others have maintained normal rhythm for 2 to 4 years, two having taken quinidine for 3 months only, and two having taken 5 grains twice a day for a year as slight hyperthyroidism was still present. But Cases XXX and XXXII relapsed 5 weeks and 6 months after stopping quinidine, and have therefore taken it regularly for 10 and 8 years.

After operative treatment, therefore, it is not necessary as a rule to take a maintenance dose of quinidine after the first month. But if normal rhythm is restored without operation, the after-treatment should be for 3 or 6 months, and if the patient relapses when it is omitted the choice will be between advising an operation or continuing quinidine treatment.

IV. *After-treatment*

In a previous paper (18) it was concluded that as relapses were more likely to occur on omitting quinidine, the after-treatment should generally be prolonged, but might be short if there was no other evidence of heart disease. In this series 5 grains of quinidine were generally given three times a day for a month after normal rhythm had been restored. This dose was then reduced to twice a day for a month, and later often to once a day, at a time depending on the type and severity of the heart disease. Continuous treatment with quinidine was generally advised for rheumatic patients and for thyrotoxic patients in whom operation was deemed unnecessary, but this was not always carried out. In those without goitre or a rheumatic heart the after-treatment was generally stopped after three months, unless there were some special features.

It is difficult to decide if after-treatment is necessary or not. There are five possible eventualities, viz.:

Normal rhythm still present	(1) without regular quinidine (2) with regular quinidine
Relapse to fibrillation	(3) within a few months of stopping quinidine (4) in spite of regular quinidine (5) one or two years after stopping quinidine

If most cases fall in group (1) after-treatment is obviously not necessary, and this was the case with the patients who had partial thyroidectomy. If most patients fall in groups (2) and (3) after-treatment is obviously necessary. Groups (4) and (5) do not help much, except that the latter shows the possibility of maintaining normal rhythm without quinidine.

Rheumatic cases. Normal rhythm was restored in 36 of these. Group (1), which suggests that after-treatment is not necessary, contained 4 very successful cases with normal rhythm after 111 months, 92 months, 45 months, and 54 months. But they were exceptional cases, the first two having no

enlargement of the heart or valvular disease, in spite of a history of rheumatic fever, and the last two slight, if any, enlargement of the heart (maximum transverse diameter by orthodiagram 11·3 and 11·0 cm.), in spite of mitral stenosis.

On the other hand, groups (2) and (3), which suggest that after-treatment is necessary, contained 5 and 7 patients respectively, and as these were ordinary rheumatic cases with valvular disease and some enlargement of the heart they provide a more useful guide. For example, Cases 44 and 47, in both of which normal rhythm was maintained for nearly four years, were under observation and took quinidine regularly, and for this reason were among the most successful in this group, although the latter had high grade mitral stenosis and a large heart. Normal rhythm may persist for some time without a maintenance dose of quinidine even in such cases, as happened in 8 of these patients for an average period of two years. In 12 cases the forces tending to produce fibrillation were too strong, and it recurred in spite of regular after-treatment, but often this did not happen for some years and did not indicate that quinidine had been of no use.

The following most unpromising case, first described by Parkinson and Nicholl (20), proves that prolonged after-treatment with quinidine may be successful. In 1922, when he was 47, with some hesitation because of his long history and transient hemiplegia, normal rhythm was restored. Six years later he was in good health, walking several miles a day, and during the general strike bicycled up from Tonbridge for quinidine, which he himself was anxious to take after seeing a friend relapse on its omission. In 1929 he was readmitted after a relapse, and normal rhythm was restored. He took 5 grains t.i.d. for a year and b.i.d. for eight months, the same quantity that he had taken for seven years. He finally relapsed to fibrillation after normal rhythm had been maintained for 106 months, and died two years later.

Except in cases with unusually slight signs of rheumatic infection, continued treatment with quinidine is advisable. If the patient omits it, and if a relapse occurs, it may be worth a second treatment with quinidine provided the patient agrees to continuous after-treatment.

Remaining cases. In those without rheumatic heart disease or goitre there was less need for continuous quinidine. Normal rhythm was restored in 29 cases. Group (I), which suggests that after-treatment is not necessary, contained 12, and as this was nearly half the total they cannot be regarded as exceptional. Three of the most satisfactory (Cases XXXVI, XXXVII, and XXXVIII) have maintained normal rhythm without continued after-treatment, and Case XXXIV, who seemed to need quinidine for the first two years, has now kept normal for six years after stopping it. Another 5 belonged to group (5), as they ultimately relapsed after maintaining normal rhythm for an average period of $2\frac{1}{2}$ years without quinidine.

On the other hand, after-treatment was sometimes needed, as groups (2) and (3) contained 5 and 4 cases respectively. Case XXXIII relapsed if

quinidine was not continued, but maintained normal rhythm for many years with it, and another had more paroxysms of fibrillation if it was not taken. Four others relapsed within a few months of stopping quinidine, and 3 cases relapsed in spite of regular quinidine, e.g. Case XLII, who had already relapsed several times when it was reduced in amount.

Continued after-treatment with quinidine is therefore not generally needed. The patient may be allowed to omit it after three months, and if a relapse occurs a second treatment with quinidine should be advised, and after-treatment should then be continuous.

TABLE VI

The Influence of the Size of the Heart on the Result of Treatment (Second Series) *

	Slightly enlarged.	Moderately enlarged.	Greatly enlarged.
Normal rhythm restored and still maintained	12	6	1
Normal rhythm restored but not maintained	8	10	3
Normal rhythm not restored	8	12	12

* The cases with goitre are not included.

V. *The Size of the Heart*

There is general agreement that much enlargement of the heart makes success with quinidine unlikely. We had been so much impressed previously with the importance of a short history (18) that where fibrillation was of recent onset quinidine was used, even if the heart was large; but it was rarely successful. In the second series of cases 71 per cent. of those where the heart was only slightly enlarged regained normal rhythm, and 43 per cent. still maintain it; with moderate enlargement the corresponding figures were 57 and 22; but with great enlargement only 27 and 7 per cent. (Table VI). If, therefore, the heart is greatly enlarged quinidine treatment should rarely be used.

The decision as to the degree of enlargement was made on general impressions after X-ray examination, taking into account the size of the chest. It would be satisfactory if agreed figures could be reached relating the size of the heart with the weight of each patient, and some tentative suggestions on these lines follow. For a patient of about 10 stone anything under 13·0 cm. maximum transverse diameter may be taken as only slightly enlarged, from 13·0 to 14·0 cm. as moderately enlarged, and anything above that as greatly enlarged. For a patient of 12 stone or over these figures would be 1·0 cm. larger, and for a patient of 8 stone or under about 1·0 cm. smaller.

Table VII shows the average maximum transverse diameter of the healthy heart, the upper limit of normal, and the suggested standard for deciding if the size of the heart makes treatment by quinidine advisable. The figures for the healthy heart have been reached by combining the results of various

workers, especially Vaquez and Bordet (23) and Treadgold and Burton (22). If the heart is only slightly enlarged on this scale quinidine has a good chance of lasting success unless there are other contra-indications; if the heart is greatly enlarged on this scale it should only be used in exceptional circumstances. Figures between slightly and greatly represent those called moderately enlarged, when other factors must decide.

TABLE VII

The Size of the Heart

	Maximum transverse diameter of healthy heart (cm.).		Suggested standard for enlargement.	
Weight of patient. (lb.)	Average.	Upper normal limit.	Slightly enlarged. Less than.	Greatly enlarged. More than.
170	12·6	13·8	14·0	15·0
140	11·5	12·7	13·0	14·0
110	10·4	11·6	12·0	13·0

Changes in the size of the heart. Although the size of the heart was nearly always checked by radioscopy, it was only later that our interest became focused on accurate orthodiagramatic measurements. In 18 cases reliable figures, shortly before and shortly after the restoration of normal rhythm, showed that generally the heart diminished in size. In 10 the decrease in the maximum transverse diameter averaged 1·4 cm. (14·0 to 12·6 cm.); in 7 there was no change, and in 1 only was there an increase of 0·8 cm., this being followed by a relapse to fibrillation in 8 months. In one case in which the heart size diminished from 16·3 to 15·2 cm. with normal rhythm, it had increased again to 16·5 cm. when he relapsed a year later. This reduction was not necessarily all due to the restoration of normal rhythm, as some may have been due to the rest in bed and digitalization.

There were adequate measurements in 9 cases where treatment with quinidine was carried out on two occasions separated by some years. In 4, where the second treatment was successful, there had been no significant change in the size of the heart (13·2 to 13·5 cm.). In 2, where after the second restoration normal rhythm was only maintained for a few weeks, it had increased from 12·8 to 14·1 cm., and in 3, where the second treatment was unsuccessful, from 13·1 to 14·1 cm. If there has been an increase in the size of the heart a second treatment with quinidine is less likely to be successful.

Three of these are quoted in more detail as observations were available over several years. In Case 39 the diameter was 11·9 cm. (chest 20 cm.) before the first treatment; it had increased to 13·2 cm. eighteen months later before the second treatment, which was only successful for two months; it had increased further to 14·7 cm. after another year during which fibrillation persisted. In Case 43 a transverse diameter of 13·3 cm. (chest 22·5 cm.) in 1930 had increased to 14·0 cm. in 1931 before the second treatment, which was not successful, and to 15 cm. three years later. In Case 44 a transverse

TABLE VIII

Normal Rhythm Restored and still Maintained. Rheumatic (7 Cases)

Case number.	Sex and age.	Valvular disease.	B.P. (approx.)	Duration of aur. fib. (months).	Size of heart. (cm.) *	Duration of restored N.R. (months).	Max. daily dose of quinidine. (gr.).
1	M 25	M.S.	130/60	3	12·8	45	30
2	F 20	M.S.	120/80	1	14·2	6	20
3	F 42	M.S.	125/80	2	13·1	28	30
4	F 26	M.S.	110/80	3	13·3	14	15
5	F 37	M.S.	120/70	3	M.	30	15
6	M 20	M.S.	120/55	1	11·3	54	15
7	M 42	M.S.	125/80	1	11·0	21	20

* Where no measurement was available, S. stands for slightly, M. for moderately, and G. for greatly enlarged.

TABLE IX

Normal Rhythm Restored and still Maintained. Goitre (16 Cases)

Case number.	Sex and age.	Percentage increase of B.M.R. and type.†	B.P. (approx.)	Duration of A.F. (months).	Size of heart. (cm.).	Duration of restored N.R. (months).	Max. daily dose of quinidine. (gr.).
8	F 47	20 S	135/80	1	11·5	20	25
9	F 52	? S	140/75	24	S	29	15
10	F 53	30 P	130/75	7	13·8	19	15
11	F 29	26 P	150/80	11	13·2	25	10
12	M 49	22 P	140/85	2	12·5	13	15
13	M 56	34 S	140/90	1	M	19	15
14	F 57	40 S	135/70	18	14·0	6	15
15	F 44	47 P	150/70	2	M	48	30
16	M 48	14 S	155/80	6	13·5	6	25
17	M 46	49 S	160/85	2	15·0	25	30
18	M 47	25 P	150/80	2	11·9	48	20
19	M 59	30 S	135/70	9	13·5	14	25
20	M 58	10 S	140/80	7	15·8	15	20
21	F 54	29 S	125/85	24	11·6	16	25
22	M 42	? P	120/70	1	S	36	10
23	M 39	34 S	130/80	24	S	60	15

† P indicates primary, and S secondary hyperthyroidism,

TABLE X

Normal Rhythm Restored and still Maintained. Other Conditions (12 Cases)

Case number.	Sex and age.	B.P. (approx.)	Duration of A.F. (months).	Size of heart (cm.).	Duration of restored N.R. (months).	Max. daily dose of quinidine (gr.).
24	M 45	120/80	1	10·0	16	15
25	M 70	130/80	2	12·3	13	10
26	M 42	120/85	3	13·7	21	15
27	F 47	190/110	1	S	59	10
28	F 52	140/95	2	12·8	48	20
29	M 56	150/100	5	14·4	37	15
30	M 60	Normal	1	11·5	6	10
31	M 54	160/75	2	12·5	3	30
32	M 62	160/70	4	11·5	5	5
33	M 48	110/70	14	12·7	2	30
34	F 59	170/80	1	13·5	50	30
35	M 44	145/90	4	11·5	108	30

diameter of 12·0 cm. (chest 22·0 cm.) remained at this size certainly for two years; when a relapse occurred after four years it had increased to 12·7 cm.; treatment with quinidine was not successful and it increased to 14·5 cm. during the next year.

TABLE XI

Normal Rhythm Restored but not Maintained. Rheumatic (15 Cases)

Case number.	Sex and age.	Lesion.	B.P. (approx.).	Duration of A.F. (months).	Size of heart (cm.).	Duration of restored N.R. (months).	Max. daily dose of quinidine (gr.).
36	M 46	M.S.	130/80	7	M	30	20
37	F 45	M.S.	155/95	7	M	13	30
38	M 37	M.S.	Normal	3	12·0	28	20
39	F 40	M.S.	120/70	1	11.9	20	15
40	M 34	M.S.	120/90	2	16·3	2	35
41	M 25	A.I.M.S.	140/80	1	S	3	15
42	M 23	M.S.	105/50	1	M	20	30
43	F 33	M.S.	125/70	2	13·3	18	30
44	F 23	A.I.M.S.	120/70	2	12·2	48	15
45	M 47	M.S.	135/85	10	G	20	30
46	F 13	M.S.	130/80	1	15·0	2	10
47	F 50	M.S.	140/90	3	M	40	15
48	M 52	M.S.	—	8	13·8	9	30
49	M 42	A.I.	—	1	M	27	30
50	M 51	M.S.	140/80	3	S	14	20

TABLE XII

Normal Rhythm Restored but not Maintained. Other Conditions (6 Cases)

Case number.	Sex and age.	B.P. (approx.)	Duration of A.F. (months).	Size of heart (cm.).	Duration of restored N.R. (months).	Max. daily dose of quinidine (gr.).
51	M 55	140/80	8	M	4	20
52	M 50	120/85	2	13·4	36	10
53	M 46	130/90	180	Normal	3	35
54	M 58	190/85	3	14·4	25	30
55	M 52	130/100	5	M	12	25
56	M 37	130/80	18	11·7	24	15

In three others with rheumatic hearts where fibrillation persisted or returned quickly, there had been an increase in size, of 2·2, 3·2, and 2·0 cm. The heart size has not increased in this way in every unsuccessful case; for example, in Cases 62, 73, and 78, there was no appreciable change in five years, all these having done well with digitalis. Nor does the restoration of normal rhythm necessarily prevent an increase. In Case 26 the fibrillation started after influenza, and the heart was thought to be normal apart from the arrhythmia, but during two years of restored normal rhythm it had increased from 13·5 to 14·5 cm. (in a chest of 26·5 cm.), showing that some pathological process was affecting the heart.

In contrast with these cases, in most of which the heart size was increasing and the result was sooner or later unsuccessful, there were many very

TABLE XIII

Normal Rhythm not Restored. Rheumatic (18 Cases)

Case number.	Sex and age.	Lesion.	B.P. (approx.).	Duration of A.F. (months).	Size of heart (cm.).	Max. daily dose of quinidine (gr.).
57	F 41	M.S.	140/90	5	14·0	30
58	F 28	M.S.	110/70	2	13·7	30
59	F 22	M.S.	125/95	4	17·5	30
60	M 43	M.S.	210/135	5	M	30
61	M 59	A.I.	160/85	3	S	30
62	M 52	M.S.	130/80	4	14·5	30
63	F 46	M.S.	140/80	2	12·6	30
64	F 39	M.S.	135/90	8	16·0	30
65	M 30	M.S.	130/80	2	13·5	40
66	F 30	M.S.	110/65	5	10·3	20
67	F 50	M.S.	165/95	3	12·7	30
68	M 21	M.S.	105/80	2	15·6	35
69	M 49	M.S. & A.I.	130/80	5	G	25
70	F 23	M.S.	120/70	1	14·5	5
71	M 28	M.S.	120/80	4	16·3	30
72	F 47	M.S.	110/70	2	13·8	35
73	F 60	M.S.	200/110	2	11·6	25
74	F 35	M.S.	—	3	G	30

TABLE XIV

Normal Rhythm not Restored. Goitre (3 Cases)

Case number.	Sex and age.	Percentage increase of B.M.R. and type.	B.P. (approx.).	Duration of A.F. (months).	Size of heart (cm.).	Max. daily dose of quinidine (gr.).
75*	F 62	32 S.	140/80	4	13·6	30
76†	M 53	28 S.	140/90	2	13·C	30
77	M 46	? P.	170/90	6	S	30

* Normal rhythm subsequently restored spontaneously.
† Has since died of broncho-pneumonia after an operation.

TABLE XV

Normal Rhythm not Restored. Other Conditions (14 Cases)

Case number.	Sex and age.	B.P. (approx.).	Duration of A.F. (months).	Size of heart (cm.).	Max. daily dose of quinidine (gr.).
78	M 54	160/100	7	13·2	30
79	M 47	180/100	7	14·5	30
80	F 60	210/125	3	11·8	30
81	F 53	260/120	3	G	30
82	F 57	210/100	1	13·0	20
83	M 36	125/85	5	14·4	30
84	M 60	140/90	1	17·5	30
85	M 49	130/80	2	14·5	30
86	M 55	—	10	S	30
87	M 69	160/80	24	14·0	30
88	M 55	150/80	2	13·8	30
89	F 41	130/80	48	13·3	30
90	M 48	150/80	24	11·4	30
91	M 53	190/120	3	17·0	30

successful cases where there was no change in size over a long period. In 8 who have maintained normal rhythm for an average period of seven years measurements showed that there had been no change; in 5 of these after-treatment with quinidine was not needed.

As all cases with adequate measurements have been quoted, and many others have given the same impression, it seems that the restoration of normal rhythm generally reduces the transverse diameter of the heart by about 1 cm.; that an increasing heart size militates against the maintenance of normal rhythm and is likely to prevent successful treatment after a relapse; and that a stationary size is generally found where the response to quinidine continues to be good.

VI. *Discussion and Conclusions*

Several authors recently have expressed rather unfavourable views about the value of quinidine. Lewis (13) states that probably its use will become confined to cases which present no other signs of heart disease and to fibrillation with hyperthyroidism. Grant (8) says that quinidine treatment was abandoned because most cases soon reverted to fibrillation, and Cowan and Ritchie (4) that the restoration of normal rhythm is rarely attended by clinical improvement and that sooner or later the auricles revert to fibrillation. The first part of this statement is entirely contrary to our experience. These views perhaps depend on the earlier experience where every patient with fibrillation was treated, with the result in one series (12) that only 1 of 38 patients maintained normal rhythm after nine months.

East and Bain (6) and White (26) give a fairer summary of modern views. 'If a heart commences to fibrillate, and neither heart failure nor an active infection, nor advanced mitral stenosis is present, an attempt should be made to regain normal rhythm with quinidine at once' (6), and 'if the patient with auricular fibrillation has no congestive failure or serious heart disease or history of embolism he should be considered suitable for quinidine therapy' (26). In 28 cases kept under observation for six years, Bramwell and Ellis (2) found definite and lasting benefit in 9 (32 per cent.). Harris (9) found that normal rhythm was restored in 26 of 43 cases, and was maintained for two years in 24 per cent.

One of the most valuable studies is by Wolff and White (27), as it deals with 71 unselected cases treated before 1923 and with 62 selected cases treated in 1923–8. Normal rhythm has been maintained for six years in 12 per cent. of the first series who responded to quinidine, and for a maximum period of four years in 30 per cent. of the second series. With most of their conclusions we are in agreement, but we have found that the hyperthyroid cases respond much better than the arteriosclerotic and hypertensive, and that the size of the heart is of greater importance than they indicate. They agree that when the heart is not enlarged the case is very favourable, but did not find the degree of enlargement had much influence; probably

this is true of the restoration of normal rhythm, but not as regards its subsequent duration.

Several opinions have been given about the cases in which quinidine is specially indicated. Hurxthal (10) thought it should not be used in those with valvular disease or congestive failure, and in a later paper (11) recorded successful treatment in 88 per cent. of those where fibrillation was due to a goitre. Maynard (15) concluded that the most favourable cases for quinidine are those of short duration, without congestive failure or advanced mitral stenosis. Newman and Spiro emphasized the importance of X-ray examination of the heart (16), and thought that patients with arteriosclerosis or hypertension were more satisfactory than those with mitral stenosis (17), but in our experience this is not true of high blood-pressure. Stroud, Laplace, and Reisinger (21) reviewed 253 cases, and concluded that it should only be used in younger patients with slight or no cardiac abnormality except the arrhythmia, or in thyrotoxic cases. We have not found age to be an important factor.

Summary and conclusions. The after results of treatment with quinidine have been followed in two series of patients, one first treated in 1923–8, and the other in 1929–34; almost all have been followed up to December 1934, or until fibrillation recurred. Quinidine restored normal rhythm in 64 per cent. of 135 cases. In 34 per cent. it is still maintained after an average period of nearly four years. In 30 per cent. it was restored, but fibrillation recurred after an average period of two years. In 36 per cent. quinidine failed to restore normal rhythm, or did so for such a short time that it was of no practical importance.

Of the earlier series 25 per cent. still maintain normal rhythm after nine years, and 39 per cent. of the later series after two years. Quinidine is therefore an effective and often a lasting treatment for auricular fibrillation; its success depends on the careful selection of suitable patients. The duration of fibrillation before treatment, the size of the heart, and the aetiology are all important in estimating the chance of restoring normal rhythm, and even more so, of maintaining it for a long period.

Nearly half the cases where fibrillation had been present for less than a month still maintain normal rhythm, about a quarter of those where it had been present between one and six months, but few of those where it had been present for longer. Where the heart was only slightly enlarged, 38 per cent., where it was moderately enlarged, 18 per cent., but where it was greatly enlarged only 5 per cent. are still satisfactory. Standards for the size of the heart for different body-weights have been suggested to help in deciding if quinidine should be used.

The aetiology is important, and is the main factor in deciding if continuous after-treatment is necessary. Where there is mitral stenosis the period of restored normal rhythm is not likely to exceed four years. Only 14 per cent. of our cases with valvular disease maintain normal rhythm, and in most of these the heart is slightly, if at all, enlarged. Two very

successful results were in patients with a history of rheumatic fever, but no evidence of mitral stenosis; they have maintained normal rhythm for over eight years without continuing to take quinidine. But in the others with mitral stenosis the average period is as yet only twenty-seven months, and most of them have continued to take it. With appreciable enlargement of the heart, therefore, continuous after-treatment with quinidine is necessary. In those who have relapsed the average period of restored normal rhythm was nearly two years.

Where fibrillation is present without mitral stenosis or a goitre, the selection of cases may be made more leniently, and under favourable circumstances the rhythm may remain normal for ten years or longer. In 39 per cent. it is still maintained after an average of five years. In the 15 who could be classified as having no signs of heart disease except the arrhythmia, it is still maintained in 70 per cent. after the same period. After-treatment is not generally needed for more than three months, but if relapse occurs on omitting quinidine, a second course should be given, and, if successful, quinidine should be continued for longer. In those who have relapsed the average period of restored rhythm was over two years.

Where fibrillation is due to a goitre, nearly all cases should be treated, as, when necessary, an operation will change an unsuitable case into one suitable for quinidine. The duration of fibrillation, and even the size of the heart, are much less important in this group. A lasting success should generally be achieved, and normal rhythm is still maintained in 80 per cent. after an average of forty months. In three it has been maintained for nine years, and in three others for four years. With partial thyroidectomy continuous after-treatment with quinidine is not called for. If the patient is treated without operation the continuous administration of quinidine may be, but is not always, needed.

Thorough digitalization is important before starting treatment by quinidine. Any infection, even a trivial one, may prevent success. Except for the possibility of embolism, which is not a grave risk, serious complications are rare.

Quinidine has an important place in the treatment of auricular fibrillation—provided the cases are carefully selected. The ordinary patient seen in hospital is quite unsuitable; the risk is too great, and if fibrillation is arrested it generally returns too soon. Satisfactory results are abtained by paying attention to three main criteria: the absence of congestive failure, of a greatly enlarged heart, or of a long history of fibrillation.

The case is eminently suitable for treatment with quinidine and should certainly be given this opportunity of regaining normal rhythm, if there have been no signs of failure, *and* if the heart is only slightly enlarged (less than 13·0 cm. maximum transverse diameter in a patient of about 10 stone), *and* if fibrillation has been established less than one month.

The case is not suitable if there has been gross congestive failure or if any signs of failure persist after treatment with rest and digitalis, *or* if the heart

is greatly enlarged (more than 14·0 cm. maximum transverse diameter in a patient of about 10 stone), *or* if fibrillation has been established for six months. The presence of any one of these three usually means that treatment with digitalis should be preferred. In intermediate cases the decision will be made according to how nearly they fall into one or other of these groups.

When there is mitral stenosis these conditions must be strictly observed. Least attention need be paid to them if fibrillation is due to a goitre, as, if necessary, partial thyroidectomy will convert an unfavourable case into one favourable for quinidine.

Some of this work, including the follow up of the second series by F. W. G., was accepted as an M.D. thesis by the University of Aberdeen.

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