together with the secondary rise of the aldolase at about five days after its primary peak, and the increasing value of the serum oxidase seem to be characteristic of cardiac infarction.

Secondly, in late diagnosis where the patient comes under observation some time after the infarct, the serum transaminases may have returned to normal. Here the diagnosis may be established by finding the secondary peak of the serum aldolase and by the increasing level of the serum oxidase.

Thirdly, in prognosis the quicker return of the serum aldolase level to normal may be of aid in assessing the severity of the infarct whilst the transaminases are still elevated. The peak of the aldolase in second infarcts is also more obvious because of this.

Summary

Serial daily estimations of serum glutamic pyruvic transaminase (S.G.P.T.), serum aldolase, and serum oxidase for at least 10 days have been made in a series of cases of acute myocardial infarction. The results have been compared with similar estimations of serum glutamic oxalacetic transaminase (S.G.O.T.) and with the erythrocyte sedimentation rate (E.S.R.), temperature, and electrocardiogram.

Estimations of these enzymes have been made in 50 healthy adults. The upper limit of normal (mean plus twice the standard deviation) in the present series is S.G.O.T. 28 units, S.G.P.T. 21 units, serum aldolase 9.2 units, and serum oxidase 372 units.

Elevation of S.G.P.T. occurs in 82% of cases of myocardial infarction with a raised S.G.O.T. The rise occurs a day later, lasts a day longer, and is of much smaller degree than the rise in S.G.O.T.

Serum aldolase rises rapidly in almost all cases of acute myocardial infarction. It reaches a peak in two to three days and falls rapidly. A secondary rise occurs about five days after the initial peak.

Serum oxidase rises gradually over the first nine days, may remain steady for a few days, and then falls to normal in most cases by the end of three weeks. There is no direct correlation with S.G.O.T. levels, and serum oxidase may remain normal with markedly elevated S.G.O.T. levels.

There is no consistent correlation between the E.S.R., temperature, or electrocardiogram and the secondary rise in serum aldolase or the rise in serum oxidase.

Coronary insufficiency without infarction does not alter the level of S.G.O.T. or S.G.P.T.

Elevations of S.G.O.T., S.G.P.T., serum aldolase, and serum oxidase may occur in cardiac failure with centrilobular necrosis of the liver.

The clinical use of these enzyme estimations is discussed.

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CASES OF ATTEMPTED SUICIDE ADMITTED TO A GENERAL HOSPITAL

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Perhaps one of the deepest impressions left by a survey of the literature of suicide is the extraordinary range of ways of looking at the problem. The available scientific data on attempted suicide are collectively so very complicated and the relationship between causes so intricate that there are obvious dangers in oversimplifying concepts about it. It is not easy to devise adequate conditions of experimental control so that the various determining causes can be isolated. The main difficulties are, first, to obtain reliable evidence; secondly, to get a representative sample; and, thirdly, to relate an attempt at suicide to significant psychiatric, ecological, cultural, and other factors. This explains why the quite extensive investigations already published have only been partially successful in furthering understanding. Several workers in the field have stressed the need for more comparative studies (Sainsbury, 1955).

The present investigation attempts to analyse certain aspects of cases of attempted suicide admitted to the wards of a large general hospital in Birmingham during 1956, 1957, and 1958. The medical and surgical consultant staff in charge of these wards were specially requested to refer all their cases of attempted suicide for psychiatric assessment. Their co-operation did much to facilitate the investigation. All the cases were personally examined by one of us (J. A. H.); data were recorded on a statistical form which was evolved after a pilot study on about 30 cases not included in the final analysis. Where possible, independent evidence from relatives and other sources was obtained, and cases for which clear-cut information was not obtained were seen for out-patient follow-up or on transfer to psychiatric units.

All studies of attempted suicide are suspect on the grounds that they are not based on a fully representative sample. Certainly the most trivial and some of the more serious cases may avoid admission to hospital or be concealed in other ways. In a few cases, particularly of coal-gas poisoning in the aged and minor barbiturate intoxication, the intent to commit suicide may be missed or difficult to establish with certainty. The hospital concerned in this investigation is under an obligation

to provide an emergency medical service to the surrounding industrial area, and, as admissions are not selected on the basis of teaching or research interest or for any other reason, the sample is probably fairly representative for an English industrial city. For obvious reasons, however, some patients in the higher income groups may well have been admitted elsewhere. Some light on such social class differences has been shed by Woodside (1958).

The Investigation

Over the three-year period 48 men and 54 women were examined and the relevant data recorded. The slight preponderance of women is less than that reported by Lendrum (1933), Dahlgren (1945), Woodside (1958), Yap (1958), and several others, although suicidal attempts by men and women in Schneider's (1954) series were equally common.

TABLE I.—Age and Sex Distribution

Age Group (Years)	Males	Females	Persons		Ratio Observed to Expected
			Observed	Expected*	
15-24	12	10	22	18	1.2
25-34	10	13	23	19	1.2
35-44	9	10	19	19	1.0
45-54	8	11	19	19	1.0
55-64	4	7	11	14	0.8
65+	5	3	8	13	0.6
Total	48	54	102	102	

* See text.

Age and sex distributions are given in Table I, and comparison is made between the observed results for each age group and those expected, assuming a constant suicide rate for each age group, in the mid-1956 population of Birmingham as estimated by Neale (personal communication, 1958). The ratios of observed to expected values suggest an excess of young people and a deficiency of persons in the oldest age group, although these are not of statistical significance.

The results, of course, differ from the findings of Swinscow (1950), who clearly showed that consummated suicide* in the last 50 years has increasingly become a disorder of the elderly, with the highest rates in men over 65 and the highest rates in women aged 45 to 64. It seems probable that the young are less determined in their attempt or more easily resuscitated.

The methods employed in the suicidal attempts were as follows: barbiturate poisoning (39), aspirin and aspirin compounds (23), drugs and other poisons (18), and coal-gas (13). The small residual numbers were accounted for by cutting, strangulation, etc. Sex differences in the selected method were of some interest: 27 females had taken barbiturates compared with 12 males, whereas coal-gas was used by 10 men and only 3 women; other drugs and poisons were more equally divided between the sexes (19 men and 22 women). The incidence of barbiturate poisoning (38%) is lower than that of 63% found at Guy's by Woodside (1958) and that of 73% found by Ettlinger and Flordh (1955) in Stockholm.

The importance of social isolation has been demonstrated by Sainsbury (1955), who found that 40% of consummated suicides lived alone. Similar findings are reported by several American sociologists. Stengel (1956) found that 22 of his series of attempted suicides lived alone, but in the present investigation only 6% lived entirely by themselves. The overall incidence of

single-person households in Birmingham is 3% (General Register Office, 1954), so that living alone may be relevant to only a small proportion of attempted suicides. It should be remembered, however, that social isolation involves many factors apart from single-person households and that consummated suicide is much more probable where persons live alone and the chances of early discovery and resuscitation are more limited.

The distribution of patients with respect to civil status did not indicate a preponderance of divorced, separated, or single persons; seven were parted from their spouses. An analysis of such factors would, however, be meaningful only if a larger number could be related to the general population, standardized for age and sex.

The occupations of the patients differed little from what might be expected from any sample in the industrial areas served by the hospital: about half the men (25) held semi-skilled or skilled artisan jobs in factories, seven were general labourers, and five had retired from their occupations; the majority of the women (32) were housewives or home workers.

Unemployment for any length of time was significant by its almost complete absence from the series (one case only). At the time of the survey a high rate of employment prevailed in the area, and even handicapped people had little difficulty in getting a job. This relative prosperity of the group was reflected by the finding of only three cases of real poverty in the series; 24 had some financial stress at the time, but this was often of their own making, though perhaps aggravated by illness. In these respects the material differs from that of Yap (1958), who found that poverty and unemployment were important factors in a survey of attempted suicides in Hong Kong.

Previous Psychiatric History

In 42 cases (14 males and 28 females) there was a history of previous psychiatric breakdown, and 22 of these had previously been admitted to a psychiatric hospital for treatment. Previous suicidal attempts were known to have occurred in 20 cases, and in four of these there had been two or more previous attempts. At the time of the attempt 61 patients were under the care of a medical practitioner. While it was clear in a number of cases that skilled medical and psychiatric attention had not been effective in preventing an attempt at suicide, this finding does indicate that there is scope for preventing suicide on the lines suggested by Parnell and Skottowe (1957).

Precipitating Factors

Each case was investigated to try to ascertain the main event that immediately preceded and appeared to have precipitated the suicidal attempt. Such assessments are, of course, open to criticism because of interdependency and overlapping with other deeper and more remote causes, but, nevertheless, should provide information of value. In 42 patients (27 females and 15 males) the precipitating factor was found to be an acute interpersonal conflict; 19 of these were the immediate result of a quarrel with the spouse, 13 followed quarrels with other members of the family, and 10 came from similar conflicts with people outside the immediate family though generally involving a love affair. These findings are in keeping with those of Yap, who found that more than twice as many women as men are driven to suicide by interpersonal conflicts. Disturbed social relationships assume much more importance than social isolation in the present investigation.

*Although the term "successful" suicide is widely applied to a case of self-inflicted death, the adjective is ironical and implies the attainment of a goal which may not in fact be desired.

In 13 cases (8 males and 5 females) the immediate precipitating cause was identified with socio-economic stress (occupational difficulties, debts, and housing problems), 5 were due to accompanying somatic disease, 2 to death of kin, and 3 were triggered off by insomnia. In 6 cases a psychotic precipitant was established in the form of a hallucination or delusion which appeared to be connected with the actual suicidal attempt. No immediate cause could be elicited in 27 cases: while these included some dissimulators, many were simply depressed in mood and unable to account for their action. Other individual precipitants were encountered, such as failure of the doctor to come when he promised and the threat of a National Insurance Medical Board, but the threat of admission to mental hospital did not occur once.

Motivating Factors

Apart from the attempt to find the precipitating factor associated with the suicide, the underlying motives, so far as they were manifest, were examined. Twenty were seen to be an escape mechanism from a life situation, 8 were motivated by strong guilt feelings and a need for self-punishment, in 10 cases loneliness and hopelessness and fear of the future seemed to be fairly clearly operative. Aggressive feelings (hatred, spite, pique, and revenge) were motivating factors in 13 cases; 2 patients admitted a wish to rejoin a dead person, and in 8 cases the person revealed that the real motive was an appeal for help where none seemed forthcoming. In 25 cases the motives were more complex. These included various overlapping combinations of the motives, already enumerated, and some cases in which psychotic determinants or rarer motives, such as a noble wish not to be a burden on others, were apparent. In 16 cases no apparent motive could be found. The majority were depressed and unable to account for the attempt at suicide except perhaps in a negative way that they could see no point in a continued existence. One of the late symptoms of a depression may be an apparently motiveless suicidal attempt. Unfortunately, many such cases remain unrecognized until this symptom makes the diagnosis clear. The greatest hope of preventing suicide in these cases lies in early diagnosis and treatment.

Seriousness of Attempt

Clinical assessments were also made in each case to try to determine the seriousness of the intention to die. In some cases it was obvious from the circumstances—for example, only a small quantity of drug and the certainty of early discovery, etc.—that the patient had no real intention of killing himself, and indeed many such patients readily admitted to this. On the other hand, in some cases it was clear that the patient had every intention of dying but had been thwarted in the effort. In the remainder the intent to die lay between these two extremes or remained in doubt after inquiries. An analysis of such assessment showed that 33 were rated as determined attempts, 26 as manifestly superficial, and 43 as doubtful or intermediate. These three groups seemed to form a continuum from the most superficial to the most determined, and there was little evidence to support the existence of clear-cut populations in this respect. The thesis of Stengel and Cook (1958) that suicidal acts, irrespective of psychiatric background, are incidents in the course of struggle for adjustment which are social behaviour patterns, alarm signals, or appeals to the human environment, appears not to be correct for at least a third of our cases. It has, however, to be remembered that our evidence is based on relatively

superficial questioning of the patients only, and that we have not attempted to interpret unconscious motifs on which Stengel bases his views.

Each patient was asked if he were glad to find himself alive (by inference that he had failed to kill himself): 62 replied, "Yes," 8 said, "No," and 30 said, "Don't know," and 2 would not answer the question. Patients were also asked if they felt better, worse, or much the same since they had attempted suicide: 46 said they felt much the same, 43 said they felt better after the suicidal attempt, 11 said they felt worse, and 2 failed to respond to the question. As might be expected, the responses to these two questions showed some correlation. No patient who was not glad to be alive felt better after the attempt; 38 of the 62 patients who were glad to be alive felt better after the event. These findings are in keeping with the hypothesis that an attempt at suicide is a symbolic trial for some, which may have a cathartic effect and dramatically modify the patient's attitude to himself and those around him. A number of patients spontaneously said that the episode was a turning-point in their lives and would allow a new start, thereby confirming Stengel's (1955) contention, "Often the experience of the suicidal attempt signifies death, survival, and new beginning." The seriousness of the attempted suicide was related to the response to these last two questions. Six of the 33 determined attempts, 12 of the 26 manifestly superficial attempts, and 20 of the 43 intermediate group felt better after the episode and were glad to find themselves alive.

To compare these findings with what the patient himself said about the attempt, each was asked to say frankly whether or not he intended to die. The intent to kill themselves was freely admitted by only 51, partially admitted by 22, denied by 22, and 7 were unable to answer the question. In 11 of the 26 manifestly superficial attempts the patients denied the intent to die. This finding does suggest there is a group where suicidal behaviour is manifest and yet there is no intention or motivation to die but a hope of achieving some other aim. This group appears to correspond with that described by Stengel as showing social motivation and an appeal for help. While it seems wrong to separate attempted suicide from what precedes and what follows it, his emphasis on the social response does not, in our view, adequately convey the variety of motivation, and the outcome anticipated, in many cases. It is possible to interpret such behaviour in terms of "an appeal for help," but in cases of acute interpersonal conflict dramatic suicidal behaviour appears to be used as a hysterical mechanism by which it is hoped to obtain a change in attitude, or capitulation, of some other person.

Inquiries were made in each case on how long suicide had been contemplated before it was carried out: 63 said the action was unpremeditated and carried out on impulse, 8 said they had thought of it for some hours previously, 9 had contemplated the action for several days but less than a week, 16 had been thinking of suicide for longer than a week, and no information on this point could be obtained from 6 patients. As might be expected, it was found that prolonged contemplation of suicide was associated with the depressive disorders, while impulsive attempts were associated with psychopathic personalities and reactions to acute interpersonal conflict.

Amnesia for the suicidal attempt might be expected to be quite common. Each patient was questioned in detail about the events surrounding the suicidal attempt: 62 had a clear memory of the episode; 37 claimed amnesia

for the actual event, but in 4 of these discrepancies in their accounts suggested that the amnesia was feigned; and 3 were unresponsive to these particular inquiries.

The setting in which a suicidal attempt takes place may give some lead concerning its motivation and nature. Eighteen patients attempted suicide while in the presence of other people, and 13 were under the influence of alcohol at the time. While not invariable, there was a tendency for depressives to commit suicide alone, whereas attempts made in a spirit of anger and revenge after a quarrel often took place in the presence of, or in an adjacent room to, the person involved in the conflict.

Diagnosis

Table II gives the distribution of the patients according to their principal psychiatric diagnoses. Half the patients had depressive disorders (manic-depressive,

TABLE II.—Principal Psychiatric Diagnosis

Schizophrenic disorders . . .	8	Acute situational maladjustment . . .	13
Manic-depressive reactions . . .	18	Hysteria . . .	9
Involuntary melancholia . . .	7	Arteriosclerotic psychosis . . .	1
Neurotic and reactive depression . . .	27	Epileptic psychosis . . .	1
Psychopathic personality . . .	11	Obsessional neurosis . . .	1
Chronic alcoholism . . .	6		
			102

involuntary melancholia, and neurotic depression); 11 patients had a pathological personality, and 6 were diagnosed as chronic alcoholics.

The group classified under acute situational maladjustment (*International Classification of Diseases*, No. 326.3) calls for further comment. The main characteristic of this group was the superficial nature of the suicidal attempt, which always followed an acute conflict with another person important to themselves, an intense ambivalence towards that person, and a mood of hostile tension which resulted from the suppression of aggressive feelings. These cases showed no essential difference from the hysterical reactions because a possible advantage might ensue in the interpersonal conflict after the suicidal attempt. The motive, of which these patients were generally consciously aware, was one of moral blackmail to gain a desired effect and in particular a new attitude, or capitulation, from the person towards whom the attempt was directed. They were not classified with the hysterical reactions, because they did not show other evidence of hysterical illness; nor were they typically hysterical personalities, apart from the trait of immaturity inferred from their childish reactions to stress.

The absence of any case of anxiety reaction is of some interest but not surprising, as the majority of such cases have marked fear of death in any form. This finding accords with that reported by Robins and O'Neal (1958) and the conclusion that the risk of suicide in anxiety states is remote, though care is needed to distinguish anxiety as a manifestation of an underlying depression.

Attempted suicide is regarded by many as irrefutable evidence of psychiatric disorder. Robins and O'Neal (1958) found every patient in their series was psychiatrically ill, and state that, for United States culture, clinically well patients rarely or never commit suicide. While every patient in this series was given a psychiatric diagnosis, there were several patients among those classified as cases of reactive depressions and acute situational maladjustments who displayed little or no real psychiatric abnormality. The *a priori* assumption that every person who attempts suicide is psychiatrically ill and therefore needing treatment lacks justification in reality.

Twenty patients were found to be suffering from some accompanying physical disease. In only three cases did this disease have a clear relationship to the suicidal attempt, and intractable pain or certainty about the unfavourable outcome of some progressive disease was apparent. Excluding the case of epileptic psychosis, 5 patients were epileptic but not psychotic; 2 had been leucotomized for schizophrenia; 7 had cardiovascular disease; and 3 had respiratory diseases and 2 peptic ulcer at the time of the examination. Six patients were pregnant when they attempted suicide. There were no cases where the manifest motive for suicide was escape from pregnancy, and in none was it thought advisable to terminate pregnancy on psychiatric grounds. One patient was unmarried, and here the conflict lay between marrying a man she did not love or telling her parents.

Family Background

Specific inquiries were made into the childhood background and family history in each case. Twenty-two had an emotionally disturbed and unhappy childhood from a variety of reasons: 11 had been separated from one or other parent, or from both parents, before the age of 14 years. Six of the parents in this material had been known to be treated in a mental hospital; 13 were alcoholics and a further 13 neurotics or psychopaths. Siblings of the patients had in three instances been treated in mental hospitals, 2 were alcoholics, and a further 6 neurotic or psychopathic. In four cases there was a family history of suicide in a parent or sibling. Although apparently no significant family history was obtained in 61 cases, the high incidence of psychiatric disorder in the remainder suggests a relationship of importance which has been stressed by other investigators, notably Batchelor (1954). The story of an alcoholic and aggressive parent (generally the father), who caused the patient's childhood to be filled with fear and insecurity, was the background theme in 13 cases.

Disposal

An analysis of the disposal of the patients showed that 26 were transferred to mental hospitals as voluntary patients; 14 were referred to the duly authorized officer with a recommendation for transfer to an observation ward under a short-term order; 2 were formally certified; and 35 were referred to a psychiatric outpatient department for surveillance and treatment. There was no recommendation for formal psychiatric treatment in 25 cases. These figures, although representing the views of only one psychiatrist, do indicate that about three-quarters of these subjects were thought to be in need of some psychiatric attention, and they underline the desirability of psychiatric assessment of all cases of attempted suicide admitted to a general hospital.

Summary

102 cases of attempted suicide admitted to a general hospital serving an industrial area were psychiatrically examined. Standardized suicide rates showed a small excess of young people and less than expected in the aged. Social isolation, poverty, and unemployment did not appear to be important aetiological factors in this series. Over 60% had recently been under medical care, and there seems to be scope for preventive measures by the earlier recognition of depressive disorders. Acute interpersonal conflict was important and immediately preceded the suicidal attempt in 41% of cases, this factor being twice as common in women. Attempted suicide appears to be a continuous series, from the most

determined attempts to the most superficial gestures. In about a quarter there appeared to be no intention to die, but a hope of achieving some other aim, notably a change in attitude of another person in close relationship to the patient. In 63% of the patients the attempt appeared to be impulsive and unpremeditated. Half the cases were diagnosed as having depressive disorders. While a few cases show no psychiatric illness requiring treatment, all attempts at suicide require psychiatric investigation.

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ELECTROCARDIOGRAPHIC CHANGES IN IDIOPATHIC HYPERCALCAEMIA OF INFANCY

BY

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In 1952 Lightwood described the occurrence in infancy of a syndrome in which failure to thrive and constipation were found in association with a raised serum calcium level. This condition, to which the name idiopathic hypercalcaemia has been given, has since received considerable attention in the literature. To the symptoms already mentioned may be added thirst and polyuria, and also the association of mental deficiency, osteosclerosis, and cardiac murmurs in a group separately designated the "severe" type (Fanconi and Girardet, 1952; Schlesinger *et al.*, 1952). In the severe type the prognosis is grave, in contradistinction to the almost uniformly benign course of the majority. A connexion has been postulated between the development of this disorder and the intake of vitamin D (Lowe *et al.*, 1954), although this is still by no means certain.

The results of electrocardiographic investigation of infants with idiopathic hypercalcaemia have been given in some published reports, but there is no consistency in the abnormalities described (Fanconi and Girardet, 1952; Schlesinger *et al.*, 1952; Lowe *et al.*, 1954; Dawson *et al.*, 1954). In the belief that further information on this point would be desirable, electrocardiographic studies were undertaken on all patients coming under observation while suffering from this disorder.

Clinical Material

The material consisted of 24 patients aged from 4 to 92 weeks, admitted to one medical unit at the Royal Hospital for Sick Children, Glasgow, during 1955 to 1957. All conformed to the clinical picture described, and only one case was of the "severe" type (Case 9).

All cases showed at some point a serum calcium beyond the range encountered in healthy infants in this hospital—namely, 10.1 to 11.5 mg./100 ml. The highest values of serum calcium found in individual patients varied from 12 to 18.6 mg./100 ml.

Every patient had a history of prophylactic administration of vitamin D. The estimated total daily intake of vitamin D at the onset of symptoms and the highest serum calcium values in each patient are recorded in the Table.

Details of Cases

Case No.	Age at Admission (Weeks)	Daily Intake of Vitamin D at Onset of Symptoms (International Units)	Highest Recorded Serum Calcium (mg./100 ml.)	Changes in Contour of ST-T Complex	Remarks
1	32	1,120	16.6	Absent	
2	29	880	18.6	Present	
3	60	700	13.4	"	
4	33	1,716	15.3	"	
5	35	1,316	18.0	"	
6	48	1,120	15.7	"	
7	38	8,840	14.0	Absent	
8	20	1,450	13.9	"	
9	92	2,800	15.3	"	"Severe" type
10	37	500	12.8	"	Hyperchloraemic renal acidosis
11	21	2,200	13.0	Present	
12	4	700	12.9	Absent	Toxoplasmosis
13	35	2,700	15.8	Present	
14	20	1,500	12.0	Absent	
15	14	890	13.7	"	
16	36	1,050	16.2	Present	
17	61	3,950	14.2	"	Systolic murmur
18	33	1,866	13.8	"	
19	36	1,050	14.6	"	
20	26	1,680	14.5	"	Osteogenesis imperfecta
21	43	2,036	15.6	"	
22	4	336	12.3	Absent	
23	35	700	12.3	Present	
24	34	700	12.2	Absent	

One patient (Case 10) had hyperchloraemic renal acidosis as well as hypercalcaemia; one (Case 12) had toxoplasmosis; and another (Case 20) had osteogenesis imperfecta. With the exception of the patient with "severe" hypercalcaemia and one other (Case 17) each of whom had a systolic murmur, none had clinical evidence of heart disease.

Electrocardiographic studies were confined to the three standard limb leads and were carried out on the same day as that on which the serum calcium was estimated, but an electrocardiogram was not always obtained at the time of the highest serum calcium value.

The sensitivity of the electrocardiograph was standardized before each examination so that a current of one millivolt produced a deflection of one centimetre.

The number of electrocardiographic examinations of individual patients varied from one to seven. After one electrocardiogram was obtained, second and subsequent examinations were carried out only if the initial record was abnormal. In Cases 5 and 16 tracings were obtained at weekly intervals until the disease was thought to be cured on clinical and biochemical grounds.

Altogether 53 electrocardiograms were found to be of a quality adequate for critical scrutiny.

Results

Of the 24 patients in this series, 14 showed a distinct abnormality in the electrocardiogram at some time