MEDICAL PRACTICE

Clinical Problems

Earliest Symptoms of Coronary Heart Disease and their Recognition

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Summary

We have reviewed the histories of 320 patients in whom a diagnosis of coronary heart disease was ultimately established and traced the symptoms back to their first appearance. In 51% the first symptom was effort angina. Difficulties in recognition arose when the symptom was localized to an unusual site, when its occurrence was dependent on a combination of exercise with cold or a recent meal, or when it was induced by excitement rather than by effort. In a quarter of the cases the onset of angina was abrupt, and in these there was usually evidence of acute infarction.

In 43% of cases the first symptom was an attack of pain or discomfort in the torso occurring without any discernable precipitating factor. Again, diagnosis was difficult when the pain was in an atypical site and also when it was of brief duration associated with skeletal or abdominal disease which could cause pain at the same site, or if the patient was able to undertake strenuous exertion. In four patients cardiac pain was first experienced during a paroxysm of tachycardia. In 6% of cases the onset was marked by a symptom other than pain—most frequently dyspnoea, tiredness, faintness, or syncope.

Clinical examination was of no direct value in diagnosis. Its importance lay in disclosing factors which had to be taken into account in interpreting the electrocardiogram. The electrocardiogram was invaluable, though by no means infallible. In over half of the patients the first tracing showed major abnormalities of coronary type, and nearly a quarter more showed minor S-T/T depression consistent with coronary disease. Ten per cent. showed miscellaneous abnormalities, such as left ventricular hypertrophy or bundle-branch block, and 15% no definite abnormality.

There is as yet no completely reliable objective method of diagnosing early coronary heart disease, so that the recognition of symptoms remains of paramount importance.

Introduction

Coronary heart disease is frequently unrecognized until a patient has a major myocardial infarct or drops dead. Yet most patients have had earlier cardiac symptoms.[1-3] Some have consulted their doctors, and in a proportion of these the correct diagnosis has been made; but the recognition of early coronary symptoms is not always easy, and for this reason the present study was undertaken.

Material and Methods

We have reviewed the histories of 320 patients in whom a diagnosis of coronary heart disease was ultimately established and traced the cardiac symptoms back to their first appearance. All the patients were examined by one cardiologist (D.S.) during a period of six and a half years. Most (98%) were seen either in their own home or in private or hospital outpatient departments. In none had a definite diagnosis of coronary disease been made before. The criteria used and some details of the patients are summarized in Table I-III.

In each case a detailed history was taken, particularly of the earliest symptom which might have had a cardiac basis, and the site of any pain recorded (Fig. 1). Finally, a clinical and electrocardiographic examination was done—together with an exercise test if there was no evidence of recent infarction, rest pain, or

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TABLE I—*Criteria for Diagnosis of Coronary Heart Disease in 320 Cases*

	No. of Cases
World Health Organization* electrocardiographic criteria of "very probable" infarction	100
Other abnormalities of the S-T segment and/or T wave of coronary pattern associated with one or more of the following:	
Effort angina 132	
Classic history of cardiac pain at rest 4	
Characteristic evolution of E.C.G. 63	
Positive E.C.G. effort test 2	
Diagnostic serum enzyme pattern 11	212
Effort angina with normal resting E.C.G. and positive effort test	2
Necropsy evidence of myocardial necrosis associated with occlusion or severe narrowing of one or more coronary arteries	6

TABLE II—*Age and Sex of Patients at Onset of Symptoms*

	Age in Years						Total
	<30	30–39	40–49	50–59	60–69	≥70	
Males	2	5	36	68	43	27	181
Females	1	4	16	40	47	31	139
Total	3	9	52	108	90	58	320

TABLE III—*Interval between Onset of Symptoms and Consultation*

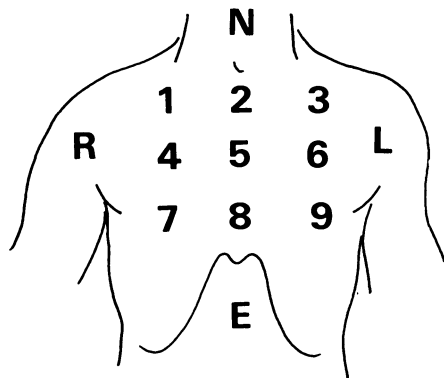| Interval ..	<12 hours	12–24 hours	1–7 days	7–30 days	1–12 months	>1 year	Total
No. of patients	14	14	69	49	99	75	320

FIG. 1—Chart for recording site of cardiac pain in shorthand. For example, pain in centre of chest was recorded as 5, and pain across upper chest, referred to right arm and neck, as 123,R,N.

crescendo angina—and blood was taken for estimating SGOT and SGPT levels when appropriate.

A history of repeated pain in the chest or adjacent areas closely related to effort or excitement was accepted as evidence of coronary disease if it was associated with electrocardiographic evidence of such disease either at the first consultation or later. Similar pain unrelated to exercise or excitement was accepted as being due to coronary disease if it, or a subsequent attack of identical character and focus of origin, was associated with objective evidence of progressive coronary disease. Other symptoms such as dyspnoea, tiredness, or syncope without pain were accepted as due to coronary disease only if associated with unequivocal evidence of recent infarction or progressive coronary disease.

Earliest Symptoms

In 94% of patients the earliest symptom of coronary disease was pain or discomfort in the chest or adjacent areas. In a little over half of these (164 patients) the symptom was induced by effort or excitement and relieved by rest; in the remainder (138 patients) it was not related to effort or excitement (Fig. 2). In 18 patients (6%) pain or discomfort was absent and another symptom was noted by the patient.
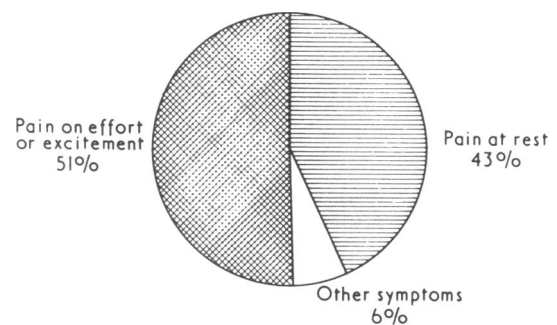

FIG. 2—Earliest symptom of coronary heart disease in 320 cases.

EFFORT ANGINA

Site.—In half of the cases the pain or discomfort was felt in the region of the sternum, and in a third as a band across the chest. In one-tenth it was left-sided, and in a similar proportion it was not felt in the chest at all but in one or both arms or shoulders or in the neck, throat, lower jaw, epigastrium, or back.

Character.—Only 49 of the 164 patients with effort angina gave a reliable description of the character of their symptom. Most (29) spoke of a sensation of tightness, constriction, or gripping in the chest, sometimes associated with a feeling of choking or suffocation; only seven described the pain as severe. Other terms used, in order of frequency, were a sensation of pressure like a lump, a blown-up feeling, a feeling as if the heart was about to burst, a dull or dragging pain, a raw, sore, or bruised feeling in the sternal area, or a burning sensation. Symptoms in the arms were described as a tightness or heaviness, occasionally accompanied by tingling as far as the finger-tips.

Precipitating Factors.—The association of pain or discomfort with effort or excitement was so characteristic that the diagnosis was rarely in doubt; but the fact that anginal pain did not occur inevitably with exercise was sometimes deceptive. When pain or discomfort was associated with excitement rather than effort the referring doctor often thought the symptom to be nervous in origin; but, in fact, a clear association with excitement (such as an argument or watching a boxing match) was just as diagnostic. Equally significant was the onset of an attack a few minutes after the start of a consultation with the specialist.

Type of Onset.—The onset of effort angina was usually insidious, but in a quarter of the cases (27%) it was abrupt. Occasionally the first attack was precipitated by exceptionally

TABLE IV—*Criteria for Diagnosis of Acute Infarction*

(1) Major S-T segment rise, with classic evolution
(2) Abnormal Q waves together with serial S-T and/or T wave abnormalities or a classic history of recent infarction
(3) Typical serum enzyme pattern in association with consistent electrocardiographic changes or cardiac pain at rest
(4) Serial S-T and/or T wave changes of coronary type in patient with effort angina of increasing severity or recent rest pain
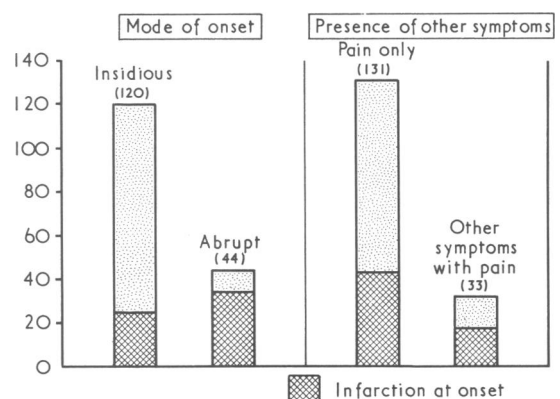(5) Necropsy confirmation

FIG. 3—Incidence of infarction at onset of effort angina related to mode of onset and presence of other symptoms.

severe exertion. Evidence of acute infarction (Table IV) was found at the first examination four times as often (82%) in the group with an abrupt onset as in the group with an insidious onset (21%) (Fig. 3). As a rule patients with effort angina of abrupt onset soon developed attacks of similar pain at rest, but sometimes evidence of infarction was found in patients who had never experienced pain at rest.

Association with Other Symptoms.—Most patients with effort angina (80%) complained only of pain but one-fifth complained of other symptoms, particularly dyspnoea or tiredness. Rather more of these showed evidence of infarction at onset (55%) than those with pain only (33%), but the numbers in the former group were small (Fig. 3).

CARDIAC PAIN AT REST

Site.—This was similar to that in patients with angina of effort.

Character.—Out of 138 patients 51 gave a reliable description of the character of their pain. Over half (28) described the symptom as severe or very severe. The commonest terms used were tightness, constriction or gripping, and indigestion (burning or discomfort associated with flatulence and nausea).

The duration of the first attack of pain varied from a few minutes to 24 hours or more (Table V). No fewer than 20% of first attacks lasted less than 30 minutes and 44% lasted less than an hour.

TABLE V—*Duration of First or Only Attack of Rest Pain*

	Duration in Hours							
	$<\frac{1}{2}$	$\frac{1}{2}$–1	1–3	3–6	6–12	12–24	>24	Total
No. of cases	25	29	21	8	11	13	17	124
No. with evidence of infarction at onset	13	19	17	7	11	12	16	95

In 14 other cases the duration of pain was uncertain.

Recurrent Brief Attacks.—Twenty-three patients had experienced two or more attacks of pain at rest, none of which exceeded one hour; in half of the patients neither attack exceeded 30 minutes. The interval between the first and second attacks of pain was less than 24 hours in eight cases and less than a week in 16. Three patients had a second attack of pain between one and four weeks after the first, and three did not have a second attack for more than a month. In nine (40%) of the 23 cases there was no evidence of infarction at the onset, compared with 15% of patients with a single attack of rest pain.

Association with Other Symptoms.—In 43% of the patients cardiac pain at rest was accompanied by other symptoms, particularly nausea with or without vomiting, dyspnoea, cough or copious expectoration, sweating, wind, faintness or syncope, and palpitation. When the pain lasted less than an hour, over an hour, and over 12 hours, the incidence was 30%, 54%, and 60% respectively. In four patients cardiac pain was first experienced during a paroxysm of tachycardia.

PAINLESS ONSET

In 18 (6%) of the 320 patients the earliest symptom was not pain but breathlessness (9 patients), tiredness (8), syncope (6), nausea, sweating, palpitation, giddiness, or wheezing (1 each).

EARLIER POSSIBLE SYMPTOMS

Thirty-nine patients had symptoms which may have had a coronary basis weeks, months, or even years before the earliest symptoms which could be accepted as definite. Sixteen recalled a brief attack of pain or discomfort in the chest or arms, 10

dyspnoea on effort, six tiredness, two a syncopal attack, and five miscellaneous symptoms such as palpitation, ankle swelling, vague malaise, or vomiting.

Earliest Clinical Findings

The findings at the first clinical examination could be divided into five categories (Fig. 4): (1) patients with no abnormal signs (almost two-fifths of the total); (2) those whose abnormalities
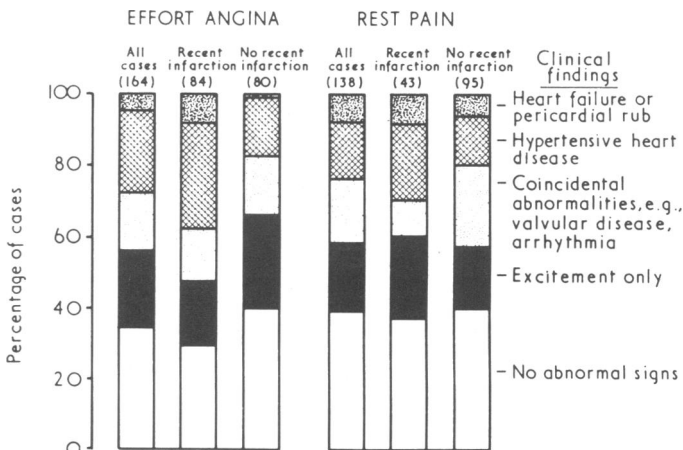

FIG. 4—Findings at first clinical examination in patients with cardiac pain.

could be readily explained by excitement—for example, a raised blood pressure or an ejection systolic murmur associated with evidence of a hyperdynamic circulation and without evidence of hypertensive or valvular disease (one-fifth of the total); (3) those with coincidental abnormalities, such as valvular disease or arrhythmias (rather less than a fifth); (4) those with evidence of hypertensive heart disease (one-fifth of the total); and (5) a small group of patients (about 7%) with either a pericardial rub or evidence of heart failure.

Earliest Electrocardiogram

In over half of the patients the first electrocardiogram showed major abnormalities strongly suggestive of coronary heart disease—for example, abnormal Q waves, T-wave inversion, S-T depression of over 0.5 mm, or S-T elevation of over 1 mm (Fig. 5). Nearly a quarter showed minor S-T/T depression consistent with coronary heart disease—namely, S-T depression of 0.25–0.5 mm, or a T wave less than one-tenth the height of the preceding R wave in one or more of leads I, II, VF, V3–6.[4][5] About 10% showed miscellaneous abnormalities such as left
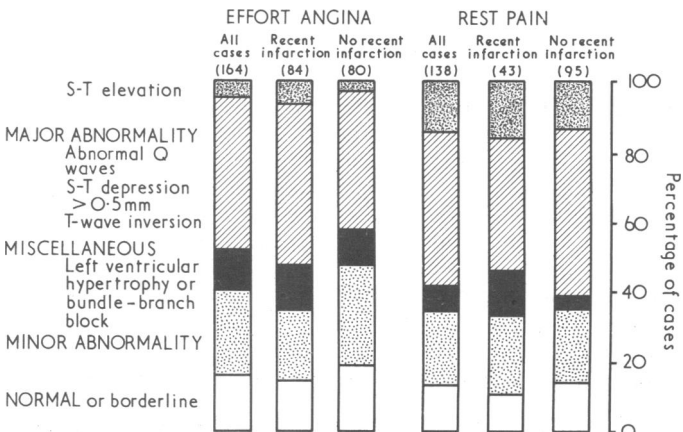

FIG. 5—State of first E.C.G. in patients with cardiac pain.

ventricular hypertrophy or bundle-branch block, and 15% were normal or borderline.

S-T elevation, the hallmark of acute infarction, was rarely seen in patients presenting with effort angina; in patients presenting with rest pain its incidence was directly related to the duration of pain (Fig. 6).
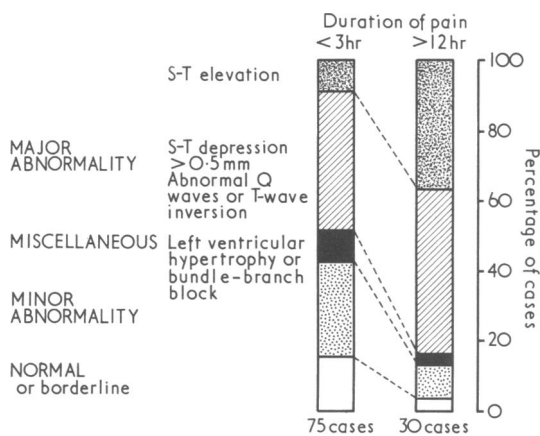

FIG. 6—State of first E.C.G. in relation to duration of first or only attack of pain at rest.

Incidence of Infarction at Onset

In patients with effort angina evidence of acute infarction (Table IV) was found in four-fifths of those with an abrupt onset compared with only one-fifth of those with an insidious onset.

In patients with rest pain the incidence of recognizable infarction at the onset was directly related to the duration of the initial attack of the pain. In those whose pain lasted over 12 hours the incidence was 97%; but even in patients whose first attack lasted less than 30 minutes there was evidence of acute infarction in 56%. Thirteen per cent. of the patients with one or more attacks of pain at rest did not show any evidence of infarction at the onset but did so later. Four per cent. never showed any definite evidence of infarction.

All but one of the 18 patients with a painless onset showed evidence of infarction when first seen; but this may simply reflect the need for stringent criteria before accepting symptoms such as dyspnoea and tiredness as evidence of coronary heart disease in the absence of pain.

Diagnostic Difficulties

It was sometimes difficult to recognize effort angina when the pain was in an unusual site, bore an inconstant relation to effort, and was associated with a normal electrocardiogram. Under these circumstances much patience and perseverance were needed to establish the diagnosis.

The diagnosis of attacks of pain coming on at rest was sometimes impossible when the patient was first seen; particularly when the pain was in an unusual site, of brief duration, associated with evidence of skeletal or abdominal disease which could give rise to pain in the same site, or when the patient was able to undertake much exertion without discomfort. As a rule the electrocardiogram was abnormal in patients subsequently shown to have coronary heart disease, but occasionally it was normal or showed borderline changes. We were reluctant to exercise a patient who might be experiencing small attacks of myocardial infarction, and in the few cases in which an exercise test was performed it was frequently equivocal or negative.

Discussion

This study has certain limitations. Firstly, it does not embrace the complete spectrum of coronary heart disease, since it is con-

fined to patients selected for specialist opinion by the family doctor. Thus it excludes cases of sudden death or massive infarction and also those with "silent" infarcts, and probably includes a preponderance of the more unusual cases. Possibly in some of these cases the earliest symptom may have been different from any that we have described. Thus probably sudden death is sometimes the first indication of coronary disease, even though Kuller found evidence of premonitory symptoms in some of these cases.[2] On the other hand, probably many patients with so-called "silent" infarcts have slight symptoms which they overlook or mistake for "indigestion."

Secondly, any survey which analyses symptoms depends on the memory, honesty, and powers of description of the patients and is therefore bound to be to some extent incomplete and inaccurate. Earlier symptoms which have subsided may be forgotten; brief attacks of pain may have been ignored or misinterpreted; the time since the onset of an insidious symptom such as effort angina is, doubtless, often underestimated. Occasionally symptoms suggestive of heart disease are deliberately concealed.

Thirdly, symptoms are influenced by racial characteristics, so that findings based on one population may not be applicable to another. The intensity and duration of any pain and its accompanying manifestations are influenced by the nervous sensibility of the patient, and this is particularly true of precordial pain. Nevertheless, we believe that our findings are broadly applicable to the Caucasian races.

EFFORT ANGINA

In this study the most frequent initial symptom was also the most characteristic—namely, angina induced by effort or excitement. It is important to emphasize that angina was by no means always described as a pain and rarely as a severe pain. Nor was it invariably "substernal" or "like a band round the chest." In one-tenth of the cases it was localized to the left anterior chest, and in a further tenth to an area outside the chest altogether. In our experience pain, discomfort, or a burning sensation anywhere between the epigastrium and mandible (including, of course, the arms) which comes on with effort or excitement and subsides quickly with rest indicates myocardial ischaemia and, in the absence of another cause, coronary disease. This is true even if the symptom is induced by exercise or excitement only under certain conditions—for example, after a meal or in a cold environment—and it is not excluded by the discovery of an extracardiac cause of chest pain, such as hiatus hernia, duodenal ulcer, or biliary disease. An abrupt onset of effort angina usually indicates myocardial infarction.

CARDIAC PAIN AT REST

Pain occurring at rest was the first symptom in nearly half of the patients. When this was in a characteristic site with radiation to the arms or lower jaw or was accompanied by shock there was usually little doubt about the diagnosis. But when the attack was brief, in an unusual site, and not accompanied by any other symptom, or when it was associated with flatulence and nausea, the diagnosis was sometimes very difficult, particularly if, as sometimes happened, the patient was able to undertake strenuous exercise without pain. As a rule the electrocardiogram was abnormal, but if it was normal, or showed no abnormalities suggestive of coronary disease diagnosis was often impossible at the first consultation. Serial electrocardiograms sometimes showed an evolving abnormality, but more often the pattern remained unchanged.

Some test which would infallibly identify patients experiencing cardiac pain at rest is greatly needed; but as yet there is none, for all those suggested have drawbacks. Even coronary arteriography is not an infallible means of determining whether chest pain is of coronary origin or not in an individual case.

SYMPTOMS OTHER THAN PAIN

Symptoms other than pain—particularly dyspnoea, tiredness, faintness, and syncope—were occasionally the first indication of coronary heart disease. These symptoms are much less definite than pain and more often due to diseases other than of the coronary system. Fortunately in most cases of coronary origin the electrocardiogram was abnormal. Painless infarction may be commoner than our study indicates, but without the support of electrocardiographic or enzymic evidence the diagnosis can be only tentative.

CLINICAL EXAMINATION AND E.C.G.

Clinical examination was rarely helpful in deciding whether a patient had coronary heart disease or not unless there had been a large myocardial infarct. Though the absence of a fall in blood pressure is commonly held to exclude infarction we found a high pressure more often than a normal or low one. The reason for this is that pain, apprehension, and the excitement of a doctor's visit together have a pressor effect which outweighs the hypotensive effect of a small infarct. Conversely, an apparent fall of blood pressure is often found in patients with chest pain of non-cardiac origin, because at the first visit there are factors tending to raise the pressure, whereas at the second visit the pain may have subsided and the patient may be less apprehensive.

The main value of clinical examination is to observe factors which may affect the interpretation of the electrocardiogram,

such as the presence of hypertensive or valvular disease, obesity, or an abnormally shaped chest.

The electrocardiogram was of great value in that it usually provided objective support for a diagnosis of coronary heart disease—provided that due weight was given to the minor abnormalities of the S-T segment and T wave.[5] [6] Half of the patients in whom coronary heart disease was eventually proved showed major abnormalities in their first tracing, and half of the remainder showed definite minor abnormalities suggestive of coronary disease. In about 10% of the cases the electrocardiogram showed left ventricular hypertrophy or bundle-branch block, and in 15% no definite abnormality was present. Serial recordings showing an evolving pattern were valuable evidence of myocardial infarction. In patients with non-progressive symptoms, such as chronic effort angina, an effort test sometimes gave vital supporting evidence, but in patients with a history of angina of abrupt onset or attacks of rest pain the likelihood of acute infarction was believed to render the test dangerous.

References

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Clinical Endocrinology

Hypertension with Aldosterone Excess

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Hypertension associated with an abnormally high secretion rate of aldosterone occurs in various conditions. Hypokalaemia is often an important clue to the presence of an excess of aldosterone, and special precautions are necessary to obtain accurate clinical measurements of the plasma potassium level (see later). Estimation of the plasma level of renin or angiotensin II is also of great help in the differential diagnosis of hyperaldosteronism.

Renin is an enzyme, of renal origin, which reacts with a substrate ("renin-substrate"; "angiotensinogen") found in the alpha-2 globulin fraction of plasma, releasing the decapeptide, angiotensin I. The latter is thought to be largely inactive, but is converted in the circulation to the active octapeptide, angiotensin II, which has several pharmacological (and possibly physiological) actions in man. These include the stimulation of aldosterone secretion; raising the blood pressure; a direct action on the kidney modifying the excretion of water and electrolytes; the provocation of thirst; and perhaps several others (Fig. 1).

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The concept that the renin-angiotensin system might be important in regulating aldosterone secretion was put forward by Gross[1] [2] and Davis.[3] According to this notion (Fig. 2), the kidney responds to sodium depletion by releasing increased amounts of renin into the circulation; consequently the quantity of angiotensin formed is increased and this stimulates the
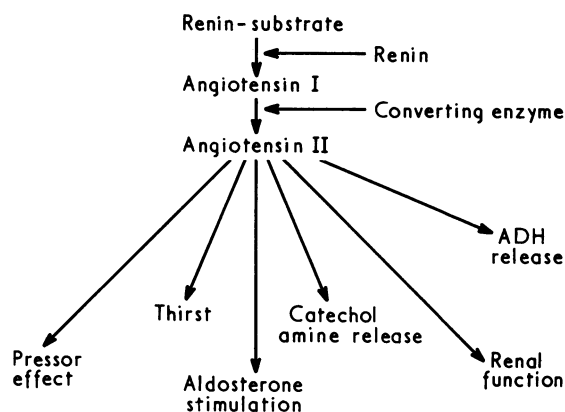

FIG. 1