In late August, 1972, I examined, in consultation, a 39-year-old man without known antecedent heart disease for acute myocardial infarction. This followed a bout of generalized urticaria associated with severe hypotension, collapse, and cyanosis, after he was stung by numerous “yellow jackets.” A 66-year-old gardener, seen in consultation by a confrère only two days earlier for a similar reason, likewise had had no previous experience with coronary artery disease. He was quite knowledgeable about hymenoptera and declared that it was by hornets that he had been stung. Well aware of the danger in the sting, each patient rushed to the emergency ward of the nearest general hospital. In each instance a period of collapse, hypotension, and cyanosis, lasting at least a half-hour, followed multiple stings and preceded the onset of severe chest pain and the succeeding demonstration of the classical electrocardiographic sequence of acute myocardial infarction.

Case reports

Case 1. H. E., a 39-year-old executive, while working in the back yard of his home at about 5:45 P.M., Aug. 19, 1972, was suddenly seized upon by yellow jackets, and stung on the scalp and in six or seven places on the legs. Knowing his vulnerability to stings, his wife drove him at breakneck speed the few miles to the emergency room of the Lawrence General Hospital. En route he removed one of the wasps from his clothes, felt his tongue enlarging, and became more and more short of breath. By the time of arrival some fifteen minutes later, he was unconscious and his blood pressure unobtainable. His first attendant nurse, thinking that he had had a heart attack and not aware that he had been stung, recorded an electrocardiogram (Fig. 1, B). This was within normal limits. At 5:56 P.M. he was given 0.5 c.c. of epinephrine subcutaneously. This was repeated at 6:09 P.M. He was then given 40 mg. of Solu-Medrol by intravenous drip. From 6:15 to 6:30 P.M. he had a severe shaking chill, pain in his joints, and his wife noticed that his fingertips became blue. Half- or three-quarters of an hour later, for the first time, he experienced a severe pressure pain across the chest and in the shoulders, broke out in a profuse sweat, and became incontinent. His blood pressure was then 92/70. At about 8 P.M. he was transferred to the intensive-care unit. About twenty minutes later, elevation of the RS-T segments and arrhythmias including sinus arrhythmia (or sino-atrial block) and ventricular premature beats were first noticed on the monitoring screen (Fig. 2). The second complete electrocardiogram, recorded at about 9:30 P.M. (Fig. 1, C) showed changes diagnostic of an acute anteroseptal myocardial infarction and the patient was transferred to the coronary-care unit. His blood pressure was then 150/65. His further hospital course was quite uneventful. The early ventricular irritability disappeared following lidocaine therapy. An electrocardiogram performed on Aug. 23, 1972 (Fig. 1, D) showed a return of the RS-T segments toward the isoelectric line and late inversion of the T-waves. A tracing taken on Sept. 5, showed more widespread inversion of the T-waves, but some persistent elevation of the RS-T segments (Fig. 1, E). Fluoroscopy performed shortly before discharge showed a ventricular bulge on systole, compatible with a ventricular aneurysm.

When re-examined on Oct. 4, 1973, he reported two bouts of dyspnea and, for the first time, on one or two occasions, tightness in the chest on exertion. Examination was not remarkable. The electrocardiogram was quite like that recorded on Sept. 5, 1972 (Fig. 1, E). On Oct. 30, he noticed, during trying domestic situations, the same intermittent sense of tightness or heavity. On examination, he showed an S3 gallop; his electrocardiogram was unchanged. Scratch tests with a mixed stinging insect’s extract were “positive” in a dilution of 1:100 but not in weaker dilutions. Intradermal test with 1:1,000,000 dilution of the same extract was negative. He was given 0.05 c.c. of the same dilution subcutaneously and it was planned to continue with weekly increasing doses in the effort to immunize him. He was given a “stinging insect first-aid treatment kit” and told to carry it with him at all times. He had been stung by a single wasp in June, 1972, and...
Fig. 1. Case 1. acute anteroseptal myocardial infarct following sting of yellow jackets. 
A, normal tracings recorded at annual “check-up” on Aug. 9, 1972. B, substantially unchanged tracings recorded on admission to the emergency room on Aug. 19, 1972; minimal but unimpressive depression of RS-T segments in Leads V, V4, and V5. C, tracings recorded three hours later showing changes decisive of early anteroseptal infarct. D, tracings four days later showing sequential changes of acute transmural infarction. E, Twelve days later, T-waves show late inversion but RS-T segments are still somewhat elevated.

Fig. 2. Case 1: strips recorded on monitoring screen between Figs. 1, B and 1, D showing sinus arrhythmia (or sinoatrial block) at 8:20 and 8:35 p.m., ventricular premature beats at 9:40 and 10:00 p.m. Pronounced RS-T segment elevation throughout. Prominent Q-waves best seen in premature beats.

developed a red, itching, local swelling which measured six to seven inches in diameter and lasted about a week. An annual check-up had been done on Aug. 9, 1972. An electrocardiogram taken at that time (Fig. 1, A) was normal. The patient was advised to lose twenty pounds, was cautioned of the danger of bee stings, and advised to submit to a program of desensitization.

As a boy of fourteen or fifteen he had been bitten by a thick, furry-bodied, multicolored caterpillar following which he developed severe urticaria. He was effectively treated for this with gamma-globulin. Though he had previously been stung by bees many times without reaction, he was warned at that time that he was very sensitive to insect bites.

Case 2. While clipping bushes on Aug. 21, 1972, C. W., a 66-year-old gardener with Parkinson’s disease, but without overt antecedent heart disease, was stung by about fifteen hornets. He remained in the yard for twenty to thirty minutes, was then taken to the accident floor of the Quincy City Hospital
Acute MI after wasp sting

Fig. 3. Case 2: acute diaphragmatic infarct and transient atrial fibrillation following hornet stings. A, normal tracings recorded in 1963 identical with second (unreproduced) control tracing recorded in January, 1972. B, tracings recorded on the day after admission showing atrial fibrillation and elevated RS-T segments in Leads III, aVF, and V6. C, twelve days later showing return to normal sinus rhythm with slight RS-T elevation in Leads II, III, and aVF and more prominent Q-waves in Lead III.

Fig. 4. Anaphylactic shock, presumptive, from hornet sting 2641 B.C. Great Ebony label from Menes' tomb at Abydos. A, photographs by Sir F. Petrie. B, Drawing from same by L. A. Waddell, and C, detail of "fatal fly" on Menes' label identified as wasp or hornet. The figures in C are drawings by Waddell from lowermost panel in A. (Reproduced from reference No. 5 by permission of Luzac and Co., London).

where he arrived within fifteen to twenty minutes. On arrival he was unconscious and showed a diffuse, itching, urticarial eruption, particularly on the arms and legs and at the sites of the stings. His fingers were purple and cold and the joints of his fingers and toes were swollen. He vomited twice and was incontinent of urine and feces. His blood pressure was 85 systolic, 60 diastolic; his heart rate was rapid, at times regular, at other times irregular. He was given epinephrine 0.3 mg. in 10 c.c. of normal salt solution by vein, diphenhydramine hydrochloride (Benadryl) 50 mg. intramuscularly, and then an intravenous drip of 1.5 Gm. of aminophyllin in 1,000 c.c. of dextrose in water. The epinephrine was repeated in the same dose and by the same route every twenty minutes for three doses. The patient revived about a half-hour after these measures were started. He then, for the first time, complained of pain in the chest. This lasted about two hours. An electrocardiogram now showed paroxysmal atrial fibrillation and changes very suggestive of early diaphragmatic or inferol-
teral myocardial infarction (Fig. 3, B). These changes were in
distinct contrast to two normal sets of tracings, each recorded
at the Quincy City Hospital, the first in 1963 (Fig. 3, A) when
he was treated for pneumonia; the second in January, 1972.
On the day after admission, the electrocardiogram showed
changes distinctive of acute diaphragmatic infarction. Follow-
ing this, he demonstrated classical sequential changes of acute
inferolateral infarct. The serum transaminase (SGOT) attained a
maximal level of 128 units (normal less than 40)
and the creatine phosphokinase (CPK) 130 units (normal less
than 60) on the second hospital day. He had been stung on
many previous occasions and was considered to be allergic to
bees and wasps.

On the initial therapy outlined above, followed by two
successive intravenous infusions of 100 mg. of hydrocortisone
and, over the ensuing three days, Medrol 4 mg. every six hours,
his blood pressure rose to 130/70 and remained in that range.
Thereon, he had an uncomplicated clinical course and has
done very well since discharge. He quit his work as a gardener,
continued for a time as a hospital employee, then retired. He
has had no angina pectoris since his bout of acute myocardial
infarction.

Discussion

In every-day usage a “bee sting” means the
sting of any one of the hymenoptera. Even among
physicians, the word “bee” is commonly used in
this generic sense. The yellow jacket, it must be
said, is not a bee. Like the hornet, it is a vespine
wasp. 1, 2 The testimony of most laymen on the
identity of a biting insect is even more unreliable
entomologically. As emphasized by Mueller, 3
when a person, especially a child, even if properly
taught, is stung for a second time “the question
whether the stinging insect had a truncated or
petiolate abdomen, or a face with an extended
oculomalar space assumes little more than aca-
demic importance”; Frazier 1 considered a more
precise identification both desirable and fea-
sible.

Accounts of fatalities following the sting of
hymenoptera date well back into antiquity.
Brown 4 tells of Menes, navigator son of Sargon
the Great, who about 2641 B.C. was stung by a
hornet while exploring the “Land of the End of
the Sunset”—allegedly Erin—and died almost
immediately 3 (Fig. 4). The Talmud tells of a
Galilean who consented to lecture upon an eso-
teric and, to him, forbidden subject, whereupon
“a wasp came out of the wall and stung him and
he died.” If these fatalities followed immediately
after the sting, as is implied in these accounts but
not clearly stated, their mechanism could differ
from that of the present two survivors.

Death may occur immediately—before the
subject recovers from shock—or it may be
delayed; and the delay may be brief or protract-
ed. 4-10 Reactions of this sort have been recorded
when the sting is single or multiple. 9, 12 Those
deaths occurring during the period of uncon-
sciousness are now regarded as the result of
anaphylaxis or, more specifically, of anaphy-
lactic shock. In those individuals who recover,
anaphylaxis may be demonstrated to the hy-
menoptera or their venoms. 16-17 Those fatalities
which occur later may result not from the general
effect of shock as such but perhaps from specific
local effects (Vide infra). In the fatal case of
myocardial infarction described by Berlin 13 and in
each of the two surviving individuals described
here, a hypotensive interval followed the sting
before the patient was seized with chest pain and
experienced the classical sequence of events
denoting acute myocardial infarction.

Death from anaphylactic shock, in general, is
said to occur within a half hour, 13 from insect
stings to within an hour. 19 Five out of six deaths
from systemic anaphylaxis reported by James
and Austen 20 occurred within an hour after the
parenteral injection of antigen. The only patient
in that group who died after bee stings was found
dead twenty minutes after being stung. In all but
one of these cases, the authors adduced evidence
of an anaphylactic reaction involving the respira-
tory tract. A sixth patient died about two hours
after the injection of penicillin and streptomycin;
here the authors suspected a nonrespiratory, pos-
sibly cardiac, mechanism for this was the only
patient in the group with chest pain and arrhyth-
mia.

In each of the patients described in the present
report, a definite interval—a half or three-
quarters of an hour in the first, over an hour in
the second—elapsed between sting and chest pain.
During this period each patient went into a state
of shock and received one or more injections of
epinephrine. Thus the ensuing myocardial infarc-
tions could conceivably be the effects, not of the
wasp stings as such, but of intervening circum-
stances.

(1) Anaphylactic shock. Anaphylactic reac-
tions in general are associated with laryngeal
edema, bronchospasm, and severe hypotension.
 Alone, or in combination, these can lead to
hypoxia, general and local. It is known, furth-
more, that shock and the hypotension with which
it manifests itself, however induced, may lead to
Table I. Anaphylaxis in relation to the heart

<table>
<thead>
<tr>
<th>Authors</th>
<th>Reference No.</th>
<th>Year</th>
<th>Species</th>
<th>Procedure</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auer</td>
<td>26</td>
<td>1910</td>
<td>Guinea pig</td>
<td>Anaphylactic shock</td>
<td>Bronchoconstriction</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Dog</td>
<td>Anaphylactic shock</td>
<td>Vasoconstrictor-paralysis bowel</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Rabbit</td>
<td>Anaphylactic shock</td>
<td>Cardiac involvement</td>
</tr>
<tr>
<td>Auer and Robinson</td>
<td>27</td>
<td>1913</td>
<td>Rabbit</td>
<td>Anaphylactic shock</td>
<td>Atrioventricular block; changes in RS-T and T; none in QRS.</td>
</tr>
<tr>
<td>Criepe</td>
<td>29</td>
<td>1931</td>
<td>Guinea pig</td>
<td>Artificial asphyxia</td>
<td>Bradycardia, partial or complete A-V block, 'high take-off' RS-T, atrial and ventricular fibrillation.</td>
</tr>
<tr>
<td>Weiss, Robb, and Ellis</td>
<td>31</td>
<td>1932</td>
<td>Man</td>
<td>Injection histamine</td>
<td>Flattening or inversion of T-waves.</td>
</tr>
<tr>
<td>Wilcox and Andrus</td>
<td>28</td>
<td>1938</td>
<td>Isolated, sensitized guinea-pig heart</td>
<td>Exposure to horse serum antigen</td>
<td>Tachycardia, decrease in coronary flow and in amplitude of contraction, prolongation of P-R, changes in QRS and T, ectopic rhythms.</td>
</tr>
<tr>
<td>Blumgart, Schlesinger, and Zoll</td>
<td>21</td>
<td>1941</td>
<td>Man</td>
<td>Injection type VIII pneumococcus antiserum</td>
<td>Four doses each followed by squeezing chest pain, fifth by sudden death. Postmortem: old and fresh infarctions.</td>
</tr>
<tr>
<td>Boas</td>
<td>32</td>
<td>1942</td>
<td>Man</td>
<td>Clinical observation. Injection tetanus antitoxin. Injection typhoid vaccine.</td>
<td>Cardiac infarction followed each.</td>
</tr>
<tr>
<td>Castberg and Schwartz</td>
<td>30</td>
<td>1946-1947</td>
<td>Man</td>
<td>Injection mixed pollen (allergic shock)</td>
<td>ECG regarded as typical of 'anoxemia of heart'; no evidence suggesting specific allergic reaction in heart.</td>
</tr>
<tr>
<td>Foster and Layman</td>
<td>34</td>
<td>1952</td>
<td>Man</td>
<td>Cinchophen plus smallpox vaccine. Complained of chest pain after admission</td>
<td>Urticaria, complete heart block, and ECG of acute diaphragmatic infarct (diagnosis rejected by authors because of rapid return of ECG to normal).</td>
</tr>
<tr>
<td>Bengsset and Pejme</td>
<td>33</td>
<td>1952</td>
<td>Man</td>
<td>Injection tetanus antitoxin</td>
<td>Six days: “serum sickness.” Eight days: “weight” in chest, fall in BP, leukocytosis, elevated ESR, unstable ECG., interpreted as consistent with acute anterior infarct; (alternative explanation: pericarditis).</td>
</tr>
<tr>
<td>LeComte</td>
<td>35</td>
<td>1957</td>
<td>Man</td>
<td>Endogenous histamine</td>
<td>Retrosternal oppression</td>
</tr>
<tr>
<td>James and Austen</td>
<td>20</td>
<td>1964</td>
<td>Man</td>
<td>Injection penicillin and streptomycin</td>
<td>Severe chest pain, cough and collapse several minutes after injection. Died two hours after injection. Postmortem: subendocardial mottling near apex left ventricle (? due to terminal massage). Perivascular fibrosis and focal fresh hemorrhages in myocardium.</td>
</tr>
</tbody>
</table>

deficient coronary irrigation and thus induce myocardial infarction. 21

(2) Epinephrine therapy. As the principal component of generally recommended therapy for anaphylactic shock, each of these patients received, for its pressor effect, injections of epinephrine. Some forty years ago, epinephrine was recommended as a provocative test for angina pectoris. 22 From fear that it might induce severe coronary insufficiency or even myocardial infarction, its use for this purpose has long since been abandoned. Under certain conditions, moreover, epinephrine may be conducive to a hypercoagulable state, allegedly one of the adaptations to stress. 23-25

Allergy and anaphylaxis in relation to the heart. For at least sixty years, it has been claimed that the anaphylactic state may, in certain
Table II. Cardiac effects of stings of hymenoptera*

<table>
<thead>
<tr>
<th>Author</th>
<th>Reference</th>
<th>Year</th>
<th>Age</th>
<th>Sex</th>
<th>Clinical observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waterhouse</td>
<td>14</td>
<td>1914</td>
<td>53</td>
<td>M</td>
<td>Constriction in throat few steps after bee sting.</td>
</tr>
<tr>
<td>Dyke</td>
<td>7</td>
<td>1941</td>
<td>44</td>
<td>M</td>
<td>Previously healthy. Died 20 minutes after wasp sting.</td>
</tr>
<tr>
<td>Noble and Halley</td>
<td>36</td>
<td>1941</td>
<td>54</td>
<td>F</td>
<td>Nurse with 15-year history of cyanosis, precordial discomfort, and syncope after stings by Italian honey-bees.</td>
</tr>
<tr>
<td>Wegelin</td>
<td>11</td>
<td>1948</td>
<td>33</td>
<td>M</td>
<td>Thirty minutes after single wasp sting: dizziness, pallor, vomiting, sweating then cyanosis and loss of consciousness. Died 30 minutes after sting.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>38</td>
<td>M</td>
<td>Collapse, swelling of lips, and urticaria shortly after stung by at least two bees. Protein and red cells in urine. Died five days after sting.</td>
</tr>
<tr>
<td>Milne</td>
<td>39</td>
<td>1949</td>
<td>49</td>
<td>M</td>
<td>Long abnormally sensitive to wasp sting. Nausea, vomiting, diarrhea, profuse sweat, agonizing band-like pain around chest within ten minutes of wasp sting. Rigor, angioneurotic edema, dyspnea, and fever followed. Precordial pain lasted three days. Electrocardiogram recorded seven weeks later showed sharply inverted T-waves in Leads I and V, through V, regarded by the author as typical of anterior myocardial infarction.</td>
</tr>
<tr>
<td>Berlin</td>
<td>18</td>
<td>1953</td>
<td>49</td>
<td>M</td>
<td>Stiffness of lips, generalized urticaria, syncope few minutes after wasp sting. Palpitation after revived but ECG not recorded then. Following intravenous calcium, ECG was normal and showed regular rhythm.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>60</td>
<td>M</td>
<td>Nausea, vomiting, swelling of face immediately after sting of yellow jacket. Then followed dyspnea, chest constriction, and cold, clammy skin. Respirations slow, deep, and irregular. Heart grossly irregular, rate 132, ECG: Atrial fibrillation, ventricular premature beats, right bundle branch block, left axis deviation. Pericardial friction rub. Normal rhythm, slower rate next 2 to 3 days, then redeveloped atrial fibrillation. Died seventh day after sting.</td>
</tr>
<tr>
<td>Wey</td>
<td>9</td>
<td>1956</td>
<td>13 months</td>
<td>F</td>
<td>Stung by about 400 wasps. Collapse, cyanosis, pulse hardly palpable. Blood pressure unobtainable. Initial improvement followed day later by vomiting, tachypnea, coma, and death 36 hours after sting.</td>
</tr>
<tr>
<td>Marshall</td>
<td>10</td>
<td>1957</td>
<td>52</td>
<td>M</td>
<td>Stung by at least three wasps, followed promptly by pallor, sweating, faintness, cyanosis, loss of consciousness. Died a little more than fifteen minutes after stings.</td>
</tr>
</tbody>
</table>

* A number of other reports (37, 38, 40, 41, and 42) are omitted from this tabulation because protocol was obscure, ambiguous, or unconvincing.

species at least, have cardiac repercussions (Table I). In pointing out species differences in the mechanism of death from anaphylaxis, Auer\textsuperscript{26} noted that sudden anaphylactic death in the rabbit somehow results from cardiac involvement. With the advent of the electrocardiogram and the collaboration of G. Canby Robinson,\textsuperscript{27} he demonstrated atrioventricular block and changes in the RS-T segment and the T-wave, but no QRS changes. Wilcox and Andrus\textsuperscript{28} demonstrated in the isolated guinea pig heart certain electrocardiographic changes but no evidence of myocardial infarction. Criep\textsuperscript{29} noted similar electrocardiographic changes in the intact guinea pig. Castberg and Schwartz\textsuperscript{30} regarded the electrocardiographic changes observed in five humans with “allergic
None

Pericardial effusion. Coronary arteries healthy. No myocardial infarct described.

None

Subepicardial hemorrhages

Hemorrhages in subepicardium, subendocardium, and left bundle branch

Survived

Clinical diagnosis made in retrospect. Electrocardiograms not reproduced. Very convincing for acute infarct but description subject to alternative interpretation.

Survived

Large anterior wall infarct with fibrinous pericarditis and endocardial parietal thrombosis. Very little coronary arteriosclerosis.

Fatty degeneration of myocardium

Patchy atheromata in coronary arteries, severe and constricting in proximal LAD. Subendocardial hemorrhages upper half of septum and adjacent posterior LV wall.

Patient survived. First suggestion of allergic nature of bee sting.

No evidence that heart was affected.

Clearcut sequence of acute fatal myocardial infarct following sting of yellow-jacket.

Fresh infarct not described.

Postmortem Remarks

American Heart Journal

Acute MI after wasp sting

that are due to anaphylaxis per se from those due to the attendant shock state, to asphyxia, to hypoxia, or to specific chemical or toxic substances.

Cardiac effects of hymenoptera stings. The literature upon this subject is presented in tabular form in Table II. Jensen aply comments that physicians seem to hesitate to recognize a sting as a cause of death, ascribing it rather to heart disease or some other commonly accepted cause. This may, in part at least, explain the dearth of evidence in the literature that collapse or death following the sting of bees or wasps may result from cardiac involvement. Waterhouse's patient felt a constriction in his throat only a few steps after being stung by a bee. Following each bee sting, the 54-year-old nurse reported by Noble and Halley placed her hand over her heart as if in pain but no further evidence was given that her heart might have been affected. Horen lists among the generalized reactions to hymenoptera stings a sense of constriction in the chest. Such discomfort need not denote coronary insufficiency; a similar sensation may be induced, among other causes, by bronchospasm, by obstruction from laryngeal edema, or by endogenous histamine.

In their study of 88 fatalities from wasp sting based upon death certificates and follow-up questionnaires, O'Connor and co-workers considered seven to have had previous "heart attacks," coronary thrombosis, or myocardial infarction. They felt that underlying heart disease predisposed to a fatal outcome.

A search of the literature, in fact, brought to light only two descriptions of acute myocardial infarction following a wasp sting in which acute infarction may be regarded as at least probable. The first was clinical and dealt with a patient who survived; the report does not make it entirely clear that the patient actually suffered a myocardial infarction. The second, described in some detail above, was clinical and confirmed at postmortem. It is of medicolegal interest that in this case death was declared accidental and a 50 per cent settlement given.

It has been considered that the skin, respiratory tract, and gut are the principal target sites for allergic reactions. Harkavy has long championed the proposition that cardiac muscle per se may participate in the sensitizing, in contrast to the toxic or pharmacologic, effects of the intro-
duction into the body of certain substances, and that this may be manifested as angina pectoris, coronary thrombosis, or various arrhythmias. This view has generally been discounted. In the cases reported here too, it seems more logical to ascribe the acute myocardial infarctions to deficient coronary flow due to the anaphylactic shock caused by the wasp stings. It must be acknowledged, however, that we simply do not yet have enough data to deny that somehow the myocardial infarctions resulted not from the severe hypotension as such, but from a direct mediator release effect of the anaphylactic reaction upon the target myocardium, in effect a myocardial “hive.”

**Chemistry of the venoms.** Speculation and research have concerned the precise constituent or constituents of the sting and the role of the route of injection responsible for the reactions, both local and systemic. Is this substance in the venom itself? If so, what component or components of the venom are responsible for the reaction? If not, is it a somatic component of the insect’s body or stinging apparatus or a pollen which is borne by the insect? Is a systemic reaction necessarily the result of the inadvertent intravenous injection? Over the years some progress appears to have been made in answering these questions. Earlier studies were concerned largely with the gross pharmacologic behavior of the venom, e.g., the presence in the venom of toxic, of hemolytic, of hemorrhagic, or of neurotoxic principles, and of histamine and with the question whether it is these substances themselves or some material elaborated in the recipient of the sting in response to the injected substance or substances that is responsible for his reaction. More recently, attention has been directed to the detection in the venom of more specific chemical substances: histamine, serotonin (5 hydroxy-tryptamine), the kinins (slow reacting substance of anaphylaxis or SRS-A), acetylcholine; the polypeptides, melittin (a “direct” hemolysin), apamin (a neurotoxin), and mastocytolytic (MCL) peptide; the enzymes, hyaluronidase, phospholipase A, and phospholipase B and; more recently, the catecholamines. It has been stated by some observers that the hymenoptera and snake (rattlesnake, cobra, viper) venoms are qualitatively similar if not quantitatively identical. Rocha e Silva, Beraldo, and Rosenfeld of Sao Paulo have shown that bradykinin, a hypotensive and smooth muscle stimulating factor, is released from plasma globulin by snake venoms (e.g., that of the pit viper, Bothrops jararaca) and that the purified bradykinin isolated in this manner produces a shock-like condition when injected in dose of 5 to 10 mg. with a steady fall in blood pressure followed by a very slow return to the initial level. They speculated that bradykinin might mediate several kinds of shock and play a part in initiating vascular thrombosis. A similar kinin has been detected in wasp and in hornet venom. For a more precise discussion of the resemblances and differences of the venoms of the different hymenoptera, the interested reader is referred to the excellent survey of Haberman.

Shenken, Tamisiea, and Winter consider hypersensitivity to bee sting to be caused by a protein antigen that is part of the stinger mechanism of the bee. Indeed, extracts currently used for desensitization are made not from venom per se, but from the body of the bee.

**Therapeutic considerations.** Reference has already been made to the possible effects of one of the catecholamines, epinephrine, in precipitating angina pectoris and in accelerating a hypercoagulable state. This agent is most rapid in its effect. The venom of the honeybee, and more particularly the yellow jacket, contains considerable amounts of the catecholamines, dopamine, and norepinephrine. It has been speculated that these serve the purpose of speeding the distribution of other constituents of the venom to their sites of action.

Hemodynamic and morphologic abnormalities have been induced in the heart and circulation of laboratory animals following the administration of various sympathomimetic amines. The release or administration of catecholamines may also be involved in the induction of cardiac arrhythmias. The magnitude of this factor is uncertain and the actual situations in which it may be invoked are so complicated that it seems too speculative at present to assign an important clinical role to these substances.

Stahnke found that thermal stress, like epinephrine administration, enhances the toxicity of snake and scorpion venom. There are not many situations more terrifying or stressful than that of being bitten by a snake or a scorpion. But, epinephrine is an integral part of accepted therapy for toxicity from these causes. In view of his
observations, Stahnke implies that the traditional use of epinephrine may need re-evaluation. Similar misgivings might apply to the epinephrine treatment of bee or wasp stings as well as to that of snake or scorpion bites.

Entirely aside from envenomation, allergic reactions in general may be associated with the local release of specific substances, at least of the "slow reacting substance of anaphylaxis" (SRS-A), of an "eosinophile chemotactic factor of anaphylaxis" (ECF-A), presumably a peptide, and of histamine or "histamine-like" substances. The antihistamines and the corticoids have been used to combat anaphylactic shock. The corticoids are not devoid of their own propensity to induce thrombogenesis. But the antihistamines and corticoids are much slower in their effect than the catecholamines.

In this situation, one cannot help but be more alarmed by the immediate precarious state of the patient with anaphylactic shock, threatened as he is with deficient coronary flow. The longer this is allowed to persist, the more prone he is to develop, and presumably the larger the resultant extent of, myocardial infarction. A clinical report of two cases seen in a consultative perspective is hardly the appropriate place for a definitive statement on therapy. It does seem more logical, however, in the predicament under discussion, to reverse the shock state at any cost with the more rapidly acting substance, and to take one's chances on possible long-term theoretical objections to its use.

Summary

Over the span of two or three days in August, 1972, in two separate communities in eastern Massachusetts two men, one aged 39, the other 66, each without previous overt heart disease, were stung by wasps. Each went into shock rapidly, after an interval of over a half-hour developed chest pain and, later, sequential electrocardiographic changes diagnostic of acute myocardial infarction. Each survived; each had normal electrocardiograms before the sting. Though precipitated by allergic reactions to its use.

An intriguing case was just recently reported of a 62-year-old man with previous angina who developed pulmonary edema but no chest pain following wasp sting and went on to show rapidly reversed electrocardiographic changes attributable to subendocardial ischemia or infarction. In a sense, this sequence fills the gap as an intermediate phase between the normal and the two individuals described here who developed pain after anaphylactic shock, then proceeded, perhaps through this phase, to develop transmural infarction.

I am most grateful to Dr. Harry D. Kaloustian of Andover for permission to report Case 1 and to Drs. Joseph M. Miller and Amnon Wachman who furnished critical clinical data obtained on that patient ten days before the stinging episode; to Dr. Eliot Young who examined in consultation and called my attention to the second patient, and to Dr. George D. Davidson of Quincy for permission to report that case; to Drs. K. Frank Austen and Albert Sheffer for helpful criticism of the manuscript; to Dr. Jeremiah Evarts Greene who, as an allergist saw the first patient in consultation; to Dr. Halla Brown for furnishing reference No. 5, and to Dr. Harry A. Savitz for reference No. 6.

REFERENCES

Levine