Ventricular Arrhythmia and Stokes-Adams Syndrome
Report of a Case

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An unusual case of ventricular arrhythmia is reported with electrocardiograms showing complete attacks of ventricular tachycardia, ventricular flutter and ventricular fibrillation. The etiology is unknown. Large doses of quinidine, to the point of toxicity, seemed to halt the arrhythmia but did not prevent its recurrence. Ephedrine was given with resulting immediate improvement and no recurrence of the arrhythmia. It is suggested that ephedrine may be of value in treating Stokes-Adams attacks due to ventricular arrhythmia in which there is no heart block but an underlying bradycardia.

In recent years it has been pointed out that the classic Stokes-Adams syndrome of unconsciousness is not produced solely by periods of ventricular asystole occurring in patients with complete heart block;1, 2, 3 recurrent attacks of loss of consciousness may be due not only to ventricular standstill, but also to ventricular tachycardia, ventricular fibrillation, or all three disturbances occurring in varying sequences. There are few reports of recurrent syncope from ventricular fibrillation without heart block.4, 5, 6 The number of these in the literature is still very few, but it is apparent that heart block is not necessarily present in these cases and the widest concept of the syndrome should be syncope due to any ventricular arrhythmia.

The following case of a ventricular arrhythmia is reported because of several unusual features. The patient was observed during numerous spontaneous attacks of ventricular tachycardia and fibrillation with accompanying attacks of syncope. The etiology of the arrhythmia and the nature of the underlying heart disease, if any, are obscure. Electrocardiograms taken between attacks show a long Q-T interval, the cause of which is unexplained. Large doses of quinidine to the point of toxicity seemed to halt the arrhythmia, but did not prevent its recurrence. The myocardium degenerated and a fatal outcome seemed inevitable until ephedrine was administered by mouth with resulting or coincident change to normal sinus rhythm and no recurrence of the arrhythmia.

CASE REPORT

A white woman, age 53, was admitted to The Graduate Hospital on Dec. 1, 1949, with a history of two attacks of syncope and palpitation in the preceding 36 hours. She had been in good health with no history of cardiovascular symptoms until 9:30 a.m. the preceding day when she suddenly noticed a palpitation in her chest and felt faint and apparently lost consciousness for a few moments. When seen within an hour she felt weak, but appeared entirely normal. Physical examination was negative. The heart rate was 76 per minute and the rhythm was regular. Blood pressure was 120/80. She was started on quinidine sulfate, 180 mg. every four hours.

About 11 a.m. the next day she had another attack after which she was admitted to the hospital. A third attack at 7 p.m. was witnessed by the hospital staff and had the following features: She complained briefly of palpitation in chest, suddenly lost consciousness and developed stertorous breathing, followed in a short time by apnea. She became pale; soon a dusky cyanosis developed. With a restoration of normal rhythm there was a rapid return to a normal state. During the seizure the apical beat was chaotic, very rapid, or absent; the peripheral pulse was absent. This was the pattern of subsequent attacks which lasted from a few seconds to one or two minutes. In the ensuing 10 days these episodes recurred with varying frequency.

Past history was negative for any significant illness. Physical examination revealed a well-developed, well-nourished woman whose complete examination was negative. The heart was normal in

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size, rhythm was regular except during the attacks described above. Blood pressure was 140/80 on admission and usually 120/80. Laboratory studies were normal. These included: urinalysis, complete blood count, sedimentation rate, blood sugar, blood urea nitrogen, carbon dioxide combining power, serum calcium, phosphorus, potassium, total proteins and chlorides. Cold agglutinins were negative on December 12. Agglutination for brucellosis was positive in dilution at 1:320 on December 16; this dropped to 1:160 on January 3 and 1:80 on January 9. Agglutinations for typhoid, paratyphoid, proteus OX2 and OX19 were negative. Subsequent serologic studies were done by the virus diagnostic research laboratory at the Children’s Hospital in Philadelphia and were negative for influenza A, influenza B, Q fever, and the psittacosis-lymphogranuloma venereum group. Cold agglutination test was negative in dilutions of 1:40 or higher in that laboratory also.

The electrocardiogram taken on admission at 4 p.m. December 1 is shown in figure 1. The striking feature is the long Q-T interval. Figure 2 shows the first attack which we were able to record graphically.

As soon as the type of arrhythmia was determined to be ventricular tachycardia she was given quinidine gluconate, 0.6 Gm. intramuscularly every two hours.

Fig. 1. Electrocardiogram taken on admission, Dec. 1, 1949 at 4 p.m. showing normal sinus rhythm. Notice the long Q-T interval.

Fig. 2. Tracing taken at 7:45 p.m. Dec. 1, 1949 showing attack before quinidine was started. (A) Note the normal sinus rhythm, the long Q-T interval, and the frequent premature beats which occur just after the T waves at the so-called “supernormal” time in the cycle. (B) Ventricular and nodal tachycardia, and the termination of the attack.
Within 15 minutes after quinidine was started she had two short attacks, following which there were no seizures that day. Sedation was given for restlessness and apprehension.

The type of arrhythmia appeared to be ventricular tachycardia; later attacks showed ventricular fibrillation and combinations of the two. Figure 3 is an example of a complete attack which was recorded graphically. The cause of the whole picture was obscure.

Large doses of quinidine were given intramuscularly to prevent and to treat attacks. Every one to three hours she received 0.6 Gm. of quinidine gluconate intramuscularly or quinidine sulfate by mouth in addition. During severe attacks she received quinidine intravenously in doses of 60 to 180 mg. to terminate the alarming immediate episode. Attempts to decrease the dose of quinidine were met with recurrence of the attacks each time. A total of 64.4 Gm. of quinidine were given in the 10-day period. On this dosage she developed a blood pres-

![Graphical tracing](http://circ.ahajournals.org/)

**Fig. 3.** Tracing taken at 7:30 a.m. on Dec. 5, 1949 showing a complete attack. Note the rhythm just before the onset, ventricular tachycardia, ventricular fibrillation, ventricular flutter-fibrillation, and the ending of the attack.

sure of 80/60, urinary retention due to loss of bladder tone, deafness, tinnitus, abdominal distention, mental confusion and a diffuse erythematous skin rash.

On December 10, in spite of the toxic doses of quinidine, she continued to have short attacks. As the day progressed she gradually became worse. A heavy substernal distress developed, dyspnea became more evident, and she became slightly cyanotic. Bilateral dullness developed over the lower
lobes of both lungs; the heart was larger by percussion. An x-ray film of the chest, made at the bed-
side, showed enlargement of the heart and a bi-
lateral diffuse density of the lung fields which
“could be due to either pulmonary congestion from
heart failure or a diffuse pneumonitis.”

It appeared obvious that a fatal outcome was in-
iminent. At 10 p.m. the following changes in therapy
were made: Quinidine was stopped. Ephedrine sul-
fate, 23 mg. by mouth every three hours, was
started. Aureomycin in full therapeutic doses was
given in view of a possible developing pneumonitis
and also in view of the possibility she may have had
a myocarditis of unknown or virus etiology which
might be benefited by this antibiotic. A mercurial
diuretic was given intramuscularly in view of the
pulmonary congestion, but no diuresis resulted.

After these changes in medication there were no
more attacks. During the next day she gradually
improved. An electrocardiogram showed a normal
sinus rhythm with an occasional ventricular pre-

mature beat. The heart rate increased to about 90
per minute. The dose of ephedrine was decreased to
23 mg. every four hours. The second day she had no
complaints. Pulmonary symptoms and signs disap-

peared. Bladder tone improved and she voided
normally. All signs of quinidine toxicity disappeared.
A low grade temperature of 99 to 100 F. which had de-
veloped in the preceding three days returned to
normal. Her mental confusion cleared completely.

The subsequent course was uneventful except
for a few minor details. The multiple quinidine
injections had proved very irritating. She developed
several sterile abscesses and sloughs deep in the
buttocks which took about three months to heal.
Occasional premature contractions persisted
throughout her hospital course. She was very ap-
prehensive of these and was very slow to resume
much physical activity.

Aureomycin was stopped after 17 days. Ephedrine
was decreased to 23 mg. every six, then eight hours,
and stopped after 30 days. She was discharged from
the hospital 61 days after admission. After several
months of very limited activity following her fear of
palpitation, she gradually resumed normal life, and
to date has been following a routine life of mild
exertion. Six months after her discharge from the
hospital an electrocardiogram showed no abnor-
mality except low voltage of the T waves in all
leads; the Q-T interval was normal. Physical exami-
nation revealed no cardiac abnormalities. She is still
very heart conscious and states there is an occasional
palpitation, about two to five times a day. No cardiac
medication is being taken.

**DISCUSSION**

A myocarditis of unknown etiology could
presumably have caused the disturbances
which were present. Conceivably this condi-
tion could have produced the striking and un-
explained lengthening of the Q-T intervals,
a finding which Gittleman and co-workers7
found in 51 to 89.3 per cent (depending upon
the formula used) of 51 cases of proved acute
myocarditis. Though we cannot entirely dis-

miss the possibility, we strongly doubt the
existence of acute myocarditis since there was
nothing that went with an infectious condition
until quinidine had produced severe toxic
effects and severe heart failure had developed.
The disappearance of the low grade tempera-
ture (99 to 100 F.) which then developed as

well as all other unfavorable signs and symp-
toms with the ending of the disappearances
of rhythm seemed to be more rapid than would
have been likely had an active myocarditis
been present. No electrolyte disturbance
could be found. We, therefore, could not
demonstrate definite evidence of organic heart
disease.

The cause of the Q-T interval prolongation
is unknown in this case. Bellet8 in a recent
communication, to be published, analyzing
168 cases associated with Q-T prolongation,
lists 26 causes. It is evident that the prolonged
Q-T interval was of no help in determining the
etiology.

The type of arrhythmia during an attack
consisted of runs of ventricular tachycardia,
a prefibrillary or flutter-type of ventricular
tachycardia, and ventricular fibrillation. At
no time did she have ventricular asystole. The
syncope attacks during arrhythmia were in-
distinguishable from those one sees in syncope
due to heart block. Therefore, we would in-
clude this case in the group of Stokes-Adams
seizures due to ventricular arrhythmias other
than asystole in complete heart block. We
would emphasize, with others, that Stokes-
Adams seizures occur in patients with

ventricular arrhythmias other than heart block
and ventricular asystole.

Quinidine has long been the drug of choice
in treating paroxysmal ventricular tachycar-
dia.10, 11, 12 Recently, procaine amide (Prones-
tyl) has been used quite successfully and will
probably supplant quinidine as the most
effective drug.13

The treatment of paroxysmal ventricular
fibrillation is much less definite. There is a
difference of opinion concerning the value of
quinidine.\textsuperscript{14-19}

In this case, large doses of quinidine at
first seemed to prevent attacks, and when the
dose was decreased the arrhythmia recurred.
Increasingly large doses to the point of in-
tolerable toxicity did not prevent recurrent
attacks. We have found no report in the litera-
ture of such a ventricular arrhythmia without
heart block which was treated with such large
doses of quinidine.

Intravenous morphine and intravenous pro-
caine were of no value in this patient. Procaine
amide was not available; its value would have
been of great interest.

Ephedrine sulfate was decided upon with
the hope of increasing the normal heart rate
and thereby increasing the total duration of
the refractory state of the ventricular muscle.
The basic rhythm between attacks was a
normal sinus bradycardia with premature con-
tractions of ventricular or nodal origin. This
suggested a vulnerable state of the conduction
system and ventricular muscle which pre-
disposed to the arrhythmia. This is in accord
with the suggestion of Sprague and Davis\textsuperscript{17}
that the development of a generalized refrac-
tory state of the ventricular muscle following
contraction is responsible for the prevention
of re-entrant beats and finally fibrillation.

It has been shown by Wiggers\textsuperscript{20} that
the period of late systole is a vulnerable period
and, in order to initiate fibrillation experi-
mentally, an electric or noxious influence with
a "fibrillary threshold" must be applied during
that period in late systole at which time the
muscle has passed out of the refractory phase.

The above two considerations are illustrated
by our patient in the rhythm just before the
attack started. Note the premature beats
came after the T wave which terminated the
long Q-T interval. This is the supernormal
period mentioned by Nahum and Hoff\textsuperscript{21}
and the vulnerable period discussed by Wiggers.

The use of ephedrine was questioned con-
siderably for fear it might precipitate attacks
in a heart known to be subject to ventricular
arrhythmia. It has generally been considered
to be contraindicated in patients with ven-
tricular arrhythmias.

The other change in treatment at the turn-
ing point in this patient's condition was the
administration of Aureomycin. This conceiv-
ably could have had a role in the patient's
improvement if she had had a myocarditis due
to an Aureomycin-sensitive organism. We
have no basis for such a presumption and we
cannot suggest that the drug influenced the
cause of the arrhythmia. On the other hand,
we cannot be sure it was not of some benefit.

It would seem from our experience in this
case and that of others\textsuperscript{5, 4} that ephedrine is of
value in treating certain ventricular arrhyth-
mas causing Stokes-Adams attacks. It is
suggested that it is of value in those cases in
which the ventricular rate is slow and the
general refractory state of the ventricular
muscle is decreased. This would include the
cases of heart block with ventricular standstill
and arrhythmias, and those with slow sinus
rhythm with transient attacks of ventricular
tachycardia, fibrillation or a combination of
these. The rationale for the use of ephedrine is
to increase the refractory state of the conduc-
tion system and ventricular muscle by increas-
ing the heart rate and thereby prevent the
arrhythmia.

The formerly held theoretic objection to
this drug in patients subject to transient
ventricular arrhythmia apparently is not borne
out by clinical experience in this and other
patients with slow ventricular rates.

**Summary**

1. A case of Stokes-Adams syndrome has
been presented which demonstrates graphically
that attacks were due to ventricular tachy-
cardia, ventricular flutter (or prefibrillar
tachycardia), and ventricular fibrillation, with-
out heart block or asystole.

2. The underlying etiology is unknown. An
abnormally long Q-T interval was present
and is unexplained.

3. Large doses of quinidine to the point of
intolerable toxicity failed to prevent recur-
cences. Ephedrine sulfate was given with
resulting immediate improvement and no
recurrence of the arrhythmia.
4. It is suggested that ephedrine is of value in treating Stokes-Adams attacks due to ventricular fibrillation and impure ventricular tachycardia in which there is a basic slow rate, as well as those due to heart block and asystole. Apparently the drug acts by speeding the rate thus increasing the refractory state of the conduction system and ventricular muscle.

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SUMARIO ESPAÑOL

Un caso singular de arritmia ventricular se informa con electrocardiogramas mostrando ataques completos de taquicardia ventricular, undulación ventricular y fibrilación ventricular. La etiología se desconoce. Dosis altas de quinidina, hasta el punto de toxicidad aparentaron arrestar la arritmia pero no evitar su reaparición. Administración de efedrina resultó en inmediata mejoría y sin reaparición de la arritmia. Se sugiere que la efedrina puede ser de valor en el tratamiento de ataques Stokes-Adams debidos a arritmias ventriculares en que no hay bloque cardíaco pero si una bradicardia subyacente.

REFERENCES

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