systolic thrill. Although mild epigastric and right upper quadrant tenderness was present, the liver could not be palpated, but the splenic tip was. Neither splinter hemorrhages nor peripheral edema was noted.

Laboratory data showed a hypochromic, macrocytic anemia, with hematocrit 24 percent. Initial blood urea nitrogen was 84 mg percent and serum electrolytes were normal. ASO titer was 166 Todd units. Urinalysis showed no red cells or casts. Arterial blood gases demonstrated mild alkalosis and arterial desaturation. Admission 12-lead electrocardiogram was within normal limits. The spinal fluid was normal.

The initial problems were those of sepsis and organic heart disease of unknown cause with mitral insufficiency; bacterial endocarditis was considered probable. Multiple blood cultures grew out group A, beta hemolytic streptococci, for which penicillin therapy was indicated. Hydration and correction of the anemia was accomplished within the initial 36 hospital hours.

Antibiotic therapy was initiated on the third hospital day with 5 x 10^6 units of aqueous potassium penicillin G given intravenously every 12 hours during a 45-60 minute period. On the fourth hospital day, while the penicillin was inadvertently given as an intravenous "push," the patient's eyes and head deviated to the right and she became unresponsive. An electrocardiogram revealed ventricular fibrillation from which she was quickly resuscitated, but because of persistent mild hypotension and hypoxia, she was transferred to the intensive cardiopulmonary care unit. Throughout this acute episode there was no clinical evidence to suggest the occurrence of systemic anaphylaxis or acute pulmonary embolization.

The potassium content of the injection given was determined at the time of arrest showed only 1.7 mEq K+/L.5

Further resuscitation was not necessary. Arterial gases obtained at the time of arrest showed only mild respiratory alkalosis (pH 7.51, Pco2 25 mm Hg). Serum electrolytes obtained earlier in the day reported a serum potassium concentration of 4.0 mEq/L. The patient continued to improve with appropriate daily penicillin therapy for bacterial endocarditis.

The potassium content of the injection given was determined by diluting 1 x 10^6 units of penicillin to a volume of one liter. The concentration, as expected, was 1.7 mEq K+/L.5

**DISCUSSION**

The occurrence of cardiopulmonary arrest during the relatively rapid injection of penicillin-G containing a total of 6.8 and 8.5 mEq of potassium (K+) on two different occasions requires the reemphasis of the consequences of rapidly changing serum K+ concentration on the cardiac conducting and pacemaker fibers of the heart. It has been shown that differences in sensitivity to the absolute levels and rate of change of levels of serum K+ exist for various cardiac tissues. The S-A nodal and the larger fibers of the intermodal and intraventricular conducting systems are the most resistant to block due to K+ excess.8 This may account for the occurrence of sinoventricular conduction with absent P waves in hyperkalemia. Experimental studies have shown that block can occur at any level of the conduction system during hyperkalemia9 and that rapid increases in serum K+ can result in total suppression of pacemaker activity.9 In this patient, high grade A-V block, a Wenckebach type of A-V conduction delay, intraventricular block, asystole and ventricular fibrillation occurred when penicillin containing K+ was given intravenously. This complication of the intravenous administration of penicillin G could easily have been fatal. Sodium penicillin G would probably have been a safer drug were there sufficient cause for such large amounts of penicillin being given intravenously as a bolus.

**REFERENCES**


**Heritable Q-T Prolongation without Congenital Deafness**

**(Romano-Ward Syndrome)**

*Miklós Csanády, M.D., and Zoltán Kiss, M.D.*

An additional case of the Romano-Ward syndrome is reported. In three members of a family, the Q-T intervals on the ECGs were found to be prolonged. One of the members was resuscitated on several occasions from Adams-Stokes attacks which occurred the first day postpartum and in subsequent premenstrual periods; these attacks were caused by ventricular fibrillation. The beta-adrenergic blocking drug propranolol proved to be an effective agent in preventing attacks. Given in a relatively small maintenance dose, the patient remained free from complaints, despite the unchanged prolongation of the Q-T interval.

There are only a few reported families in which the affected members frequently suffer from ventricular arrhythmias and sudden death occurs most often at an early age. The T and U waves of the electrocardiogram produce a common complex and exhibit a bizarre shape; the Q-T or Q-U interval is prolonged. There are no other accompanying familial anomalies (such as deafness, for example, or a tendency to extracellular hypokalemia).

---

*From the First Department of Medicine, University Medical School, Szeged, Hungary.

Reprint requests: Dr. Csanády, First Department of Medicine, 6720 Szeged, Hungary.*
Two months before clinical admission, she had convulsions. The patient was admitted to a hospital, where Adams-Stokes attacks were observed on two occasions. Before admission pholedrine sulphate (Pulsotyl) drops were administered. A few minutes after, attacks of unconsciousness began; these recurred several times and were accompanied by convulsions. The patient was admitted to a hospital, where Adams-Stokes attacks were observed on two occasions. Polytopic ventricular extrasystoles were found on the ECG before, and ventricular tachycardia during, the attack. At the time of admission to our clinical ward (September 10, 1968): physical examination showed essentially normal findings, only a grade 2/6 ejection systolic murmur was presented above the pulmonary artery. The heart rate was 80 beats per minute, blood pressure 120/80 mm Hg. Cyanosis was present.

The laboratory data were as follows: ESR per 1 hr = 12 mm. The ionogram was normal; 11-hydroxycorticosteroid, 17-ketosteroid, pregnanediol, pregnantriol, and estriol were normal in 24 hour collected urine specimens, 131I uptake by the thyroid gland showed high-rising curve with normal plasma values.

At this time the patient was premenstrual. It was striking that extrasystoles were induced by the least psychic excitement. In this period, in contrast to expectations, the extrasystoles were not eliminated by lidocaine, and after its administration ventricular fibrillation developed; this was observed several times. Since the ventricular fibrillations recurred in spite of the above mentioned therapy, the drugs were changed, and propranolol (Inderal) daily 160 mg, rauwolfia and diphenylhydantoin were administered. After this change, the arrhythmia ceased in a few days, and the patient was discharged free from complaints.

Four years have passed since the last arrhythmia. The Inderal was changed for oxprenolon (Trasicor), the dose has been decreased to 10 mg daily, and increased to 20 mg only during the premenstrual period. There has been no attack, but the QT interval on the ECG has remained prolonged.

Chest x-ray and x-ray films of skull gave normal findings. Ophthalmologic and neurologic examinations did not reveal any pathologic signs.

And ECG was taken on admission (Fig 1). The T and U waves are fused and had a bizarre shape; the Q-T or Q-U interval was prolonged. A few minutes after the ECG examination, an Adams-Stokes attack was observed; it was initiated by multiple ventricular extrasystoles and these were followed by ventricular tachycardia and then by ventricular fibrillation. During the next five days many attacks were observed, accompanied by accumulated ventricular extrasystoles, ventricular flutter and ventricular fibrillation (Fig 2). On about ten occasions the arrhythmia caused typical Adams-Stokes syndrome. With the use of artificial resuscitation and intravenous lidocaine, the ventricular fibrillation ceased in every case. Once after intravenous lidocaine the ventricular fibrillation went into asystole, which ended after administration of isoprotrenol. The lidocaine was given in infusion, and it was frequently observed that polytopic ventricular extrasystoles did not develop into ventricular fibrillation, but the arrhythmia was halted by the increase of dose. The attacks ceased after administration of diphenylhydantoin, potassium, magnesium and—because of a supposed rheumatic etiology—after administration of steroid, salicylate and antibiotics. Although the shape of the T and U waves in the ECG varied occasionally, the prolonged QT or QU interval remained unchanged throughout. After about two months of observation, the patient left the clinic free from complaints. At home she took quinidine, diphenylhydantoin and salicylates and was essentially free from complaints. Once, in the premenstrual period, she felt palpitations. The ECG examination took place on the following day, and at that time no arrhythmia could be observed.

She was admitted to the clinic for the second time ten weeks later. On the day of admission she had attacks with loss of consciousness. The QT interval was prolonged as before, polytopic ventricular extrasystoles were seen followed by ventricular fibrillation.

The laboratory results agreed essentially with those found previously. The antistreptolysin titre was unchanged. ESR per 1 hr = 12 mm. The ionogram was normal; 11-hydroxycorticosteroid, 17-ketosteroid, pregnanediol, pregnantriol, and estriol were normal in 24 hour collected urine specimens, 131I uptake by the thyroid gland showed high-rising curve with normal plasma values.

CASE REPORT

This patient was a 19-year-old woman who had a noncontributory history. Two months before clinical admission, she gave birth to a full-term daughter, who, at that time, appeared healthy. One day postpartum, the patient experienced loss of consciousness. ECG examination was not performed. After this, the patient became free from complaints. Before admission pholedrine sulphate (Pulsotyl) drops were administered. A few minutes after, attacks of unconsciousness began; these recurred several times and were accompanied by convulsions. The patient was admitted to a hospital, where Adams-Stokes attacks were observed on two occasions. Polytopic ventricular extrasystoles were found on the ECG before, and ventricular tachycardia during, the attack. At the time of admission to our clinical ward (September 10, 1968): physical examination showed essentially normal findings, only a grade 2/6 ejection systolic murmurm was presented above the pulmonary artery. The heart rate was 80 beats per minute, blood pressure 120/80 mm Hg. Cyanosis was present.

The laboratory data were as follows: ESR per 1 hr = on admission 8, one week later 53, before discharge 7 mm. Antistreptolysin titre on admission 286, later on 400 U. WBC = 16,800/ per cubic milliliter. Beta-hemolytic Streptococcus was isolated from her throat culture. Blood culture several times was sterile. Serum Na, K, Mg, Ca, P, creatinine, bilirubin, protein and its fractions, blood urea nitrogen, hemoglobin, hematocrit gave normal values. Sia, Kürten, Rose, Latex tests, and Wassermann reaction were all negative.

The mode of inheritance is autosomal dominant. The clinical picture has been named the Romano-Ward syndrome, after the authors who first described it.1-5

FIGURE 1. Standard 12 lead electrocardiogram of our patient.

FIGURE 2. Rhythm strip during an Adams-Stokes attack.
HERITABLE Q-T PROLONGATION

Examination of the family

Seven members of the family were studied. The results are shown in Figure 3. The ECGs of the patient's mother and of her daughter (born during her hospitalization and now four years old) are very similar to that of the patient (Fig 4). In others, the changes are not so pronounced. The ECGs of other family members were normal. Two brothers of the patient could not be examined, because they had died in childhood; as far as the parents knew, one had died on the first day of life from a congenital cardiac anomaly, and the other at the age of two weeks of pneumonia. There was no ECG examination in either case.

Discussion

The inheritable prolongation of the Q-T interval on the ECG, associated with congenital deafness, was first described by Jervell and Lange-Nielsen. Since then the number of reported cases increased to about 20. Some authors have named the disease the Jervell-Lange-Nielsen syndrome, but in connection with a report of three cases, Jervell, Thingstad and Endsjö suggest the name "surdo-cardiac" syndrome in order to sharply distinguish it from other familial diseases accompanied by Q-T prolongation.

Romano, Gemme and Pongiglione, and independently Ward reported single families, in several members of which the Q-T interval was prolonged and the T and U waves were fused and bizarre-shaped. The hearing of the affected members of the family was normal, and extracellular hypokalemia could not be detected either. This disease has recently been named the Romano-Ward syndrome. The syndrome has an autosomal dominant inheritance, in contrast with autosomal recessive heredity of the Jervell-Lange-Nielsen syndrome.

The third form of Q-T prolongation was described by Gamstorp, Nilsen and Westling; in the family reported by them, the affected members were hypokalemic. After administration of potassium, the ECG abnormalities diminished, and the Adams-Stokes attacks ceased.

The syndrome observed by us can be classified as a Romano-Ward syndrome, because the Q-T prolongation of the ECG was accompanied by neither hearing disturbance nor extracellular hypokalemia, while the ECG abnormality was dominantly inherited probably in an autosomal manner.

In the three above-mentioned syndromes, sudden death of the affected members is frequent. This is caused by ventricular fibrillation due to prolonged Q-T interval.

In our case, the cause of ventricular extrasystoles is debatable. At first, since the erythrocyte sedimentation rate and the antistreptolysin titre increased and beta-hemolytic Streptococcus was demonstrated, we considered a rheumatic origin. On second observation, how-
ever, there were no data supporting rheumatic activity, but the attacks nevertheless occurred.

The very first attack appeared on the first day after delivery, recurred for a short time, and then spontaneously disappeared. Later it was always observed in the premenstrual period or during menstruation. There were no signs of postpartum heart disease (enlarged heart, gallop rhythm, or any sign of cardiac failure). No endocrine abnormality were found.

The patient of Ratshin et al had idiopathic QT prolongation with normal hearing and syncopal episodes caused by ventricular fibrillation which increased in frequency subsequent her first postpartum menses.

A few minutes before the first attack observed by us, Pulsotyl drops were administered. It is probable that this contributed to the development of extrasystoles, and then to ventricular tachycardia and fibrillations. Garza et al carried out pathophysiologic experiments in one of their Romano-Ward patients who had suffered irreversible brain damage; ventricular fibrillation attacks were produced with adrenaline and alpha-adrenergic stimulators (eg phenylephrine), and were stopped by propranolol.

During the observation period, the patient reacted to the least psychologic excitement with ventricular fibrillations; for instance, it was frequently observed that the banging of a door or the appearance of a new person in the ward was sufficient to produce fibrillation. Some authors consider this phenomenon characteristic of the Romano-Ward syndrome. It is also possible that the premenstrual attacks were simply the consequence of an irritable state of the patient during these periods.

Since together with our case the number of families reported to have the Romano-Ward syndrome is still less than ten, not much data are available regarding the therapy, and thus our own experience might also be of interest.

Lidocaine proved effective at first, but during the second observation it produced ventricular fibrillations many times. This rare, paradoxic property of lidocaine was confirmed by the patient still takes con-tinuously. Since then the patient has been free from complaints, and no extrasystoles could be observed.

ACKNOWLEDGMENT: We are indebted to Dr. Kálmán Ráik for reviewing the manuscript and his valuable advice.

REFERENCES
4 Romano C: Congenital cardiac arrhythmia. Lancet 1:658, 1965
5 Ward OC: A new familial cardiac syndrome in children J

Primary Carcinoma of Trachea Metastatic to Heart*

Bernard Peison, M.D.** and Manley C. Williams, M.D.†

A patient with primary squamous cell carcinoma of the trachea, with widespread metastases to the heart is reported. The tumor arose from metastatic respiratory epithelium rather than from islands of squamous inclu-sions. This uncommon neoplasm is no longer a pathologic curiosity, but one of the conditions of the upper respiratory tract that the practicing physician may be called upon to recognize and treat. Wide tracheal re-section and reconstruction is generally suggested as the preferred method of treatment.

Primary carcinoma of the trachea, in its rarity, contrasts with carcinoma of the bronchus and larynx, whose increasing frequency has been recognized during the last half of the century. The knowledge of the clinical and pathologic features of these primary neoplasms is of definite interest, for cancer of the trachea is no longer merely of academic interest as a pathologic curiosity, but is one of the conditions of the upper respiratory tract that the practicing physician may be called upon to recognize and treat.

This is a report of a case of a poorly differentiated squamous cell carcinoma of the trachea which is of interest, not only because of its rarity, but because it is the second well-documented record of a patient with this lesion who had as its cardinal finding massive metastases to the heart.

CASE REPORT

A 62-year-old white woman was admitted to Rahway Hospital on January 3, 1972 because of extreme shortness of breath. Six months earlier, an enlarged left supraclavicular lymph node was removed which revealed metastatic carcinoma. No primary source could be found; she received radiation therapy to both supraclavicular regions. Since then, she complained of dyspnea and orthopnea; she was admitted to the cardiology service of Rahway Hospital for review and referral.

*From the Department of Pathology, Rahway Hospital, Rahway, New Jersey.
**Director of Laboratories.
†Senior Attending, Department of Surgery.
Reprint requests: Dr. Peison, Rahway Hospital, Rahway, New Jersey 07065

Chest Vol. 64, No. 3, September 1973

Irish Med Assn 54:103, 1964