SUDDEN DEATH

By David T. Kelly

Death from arteriosclerotic heart disease is the most prevalent cause of death amongst adults in the United States amounting to some 650,000 deaths per year. Of this some 60% or about 350,000 died suddenly, that is within 24 hours of onset of symptoms. Most of these deaths are within the first two hours and from studies in England and the United States, we know that 70% of all deaths from coronary artery disease occur before hospitalization and only a small percentage die 24 hours after admission to hospital. Survivors of myocardial infarction are also known to have a higher incidence of sudden death. Thus the noteworthy advances in Coronary Care in all our hospitals are dealing with a relatively small group who have selected themselves by already surviving this initial period. Because little data was available on sudden death some years ago Dr. Lewis Kuller started a retrospective study of sudden death in the Baltimore area. This encompassed half the metropolitan area with about 500,000 people of all social and economic groups. In a single year samples of natural deaths in this population 1/3 in the 40-64 year age group died sudden and unexpectedly. In 60% the cause was coronary artery disease. Sudden death was defined by W.H.O. criteria as occurring within 24 hours, but of the witnessed deaths nearly 80% occurred within 2 hours. Thus the single most important cause of death in subjects age 40-64 years in his study was sudden death from coronary artery disease, accounting for some 20% of all nontraumatic deaths in this age group. Approximately 1/2 of the individuals with coronary artery disease who died suddenly had a previous history of heart disease and some 38% had seen a physician within one month of death. Of all those who died within 2 hours of onset of symptoms only 8% had no history of heart disease and had not seen a physician within one month before death. Two thirds of the people who suffered sudden death from coronary artery disease had a history of either heart disease, diabetes, hypertension or cerebrovascular disease.

In order to try and relate the extent of coronary artery disease to sudden death the coronary arteries of 121 people with coronary artery disease who died suddenly in this retrospective population survey were examined in detail. The left main, circumflex and left anterior descending and right main coronary arteries were transacted at 2 mm intervals down their lengths and the degree of obstruction of the lumen at each level was noted. All patients examined had significant and severe coronary artery obstruction. Three-fourths of all the patients had 90% or greater occlusion of one or more arteries. One hundred and three of the 121 people had severe triple vessel disease. Eighteen patients had double vessel disease. Single vessel disease with significant luminal narrowing was not found in any case of sudden death. Fresh lesions were found in many coronary arteries. Twenty-four percent had a fresh organizing thrombus in one coronary artery, 32% had a haemorrhage into a plaque. In the myocardium 9% had evidence of a recent myocardial infarction and 41% had evidence of past myocardial infarction. Most of these were found in the absence of any documented history of myocardial infarction. Of the 121 patients who suffered sudden death some 66% showed some lesion as described above either in the coronary arteries or in the myocardium. In addition, 62% showed cardiac hypertrophy in that the heart weights were greater than 450 grams.

In this retrospective study, therefore, sudden death from coronary artery disease was associated with very severe coronary artery disease and mild coronary lesions or severe single vessel disease did not appear to be associated with sudden death. A substantial incidence of cardiac hypertrophy was also seen in those who were dying of sudden death. From this retrospective analysis death, although sudden, was not unheralded as one half had a known history of heart disease and nearly 40% of all patients had seen a doctor within the previous month.

During a 7 year period from 1960-1967, more than a thousand patients were referred to Johns Hopkins Hospital as potential candidates for coronary arteriography for evaluation of chest pain. In these earlier days of coronary arteriography most of these patients were either young and had clinically definite coronary artery disease or had been referred because of the diagnostic difficulty in evaluating the chest pain. Approximately three hundred and fifty had coronary arteriography. This report is concerned with two hundred twenty-four of these patients who remain after patients with unsatisfactory studies, other significant disease or who had had surgical procedures for the coronary vascular disease were excluded. The mean age for the entire group was 41.5 years. Therefore, I must stress that this is a select population and a comparison of these data to other dissimilar populations is not warranted. One hundred and twenty-one patients were found not to have coronary artery disease and one hundred and three patients did have coronary artery disease. The predicted survival following coronary arteriography in both these populations is shown. The 121 patients with normal coronary arteries have a 97% survival up to 12 years later. This is identical to that obtained from an age and sex matched population in United States Life Insurance Tables. Two patients died of non cardiac causes. The mean period of survival whereas the 103 patients with coronary artery disease only have a 52% survival. In both groups the average post arteriogram observation is nearly 6 years. Some 27 deaths have occurred in the disease group and the mean period of observation for the 76 survivors is about 6 years. If one further divides the 103 patients with coronary artery disease into moderate and severe coronary artery disease, 57 patients have mild to moderate coronary artery disease and have 70% predicted survival; of the 46 patients with severe coronary artery disease there is only a 51% survival rate. Of these 23 deaths in this group with the severe coronary artery disease, 13 died suddenly. Using paired correlation coefficients to try and predict which patients with the severe coronary artery disease would die, it appears statistically that patients with either Q waves on the cardiogram of significantly ST segment abnormalities have a much higher incidence of sudden death than those without the EKG abnormalities regardless of the pattern of coronary artery disease. Forty-seven of the 103 patients had abnormal ST segment of which there were 22 deaths and of the 56 without ST segments abnormalities there were only 10 deaths. Hypertension and abnormal serum cholesterol did not appear to further predict death.

Of the 103 patients with significant coronary artery disease 32 had the disease confined to only one coronary artery. The mean age was 39.2 years and the mean time of follow-up now has just over 7 years with a range of 4 to 9 years. There have been 2 deaths. One patient was killed in an auto accident and postmortem examination did not demonstrate any further

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pathology in his heart. However, as it was a single vehicle auto accident the possibility of an arrhythmia or an acute infarction cannot be excluded. One further patient died a few months ago after being admitted to a hospital with a severe myocardial infarction. Forty-four percent are now complaint free, 18 have normal electrocardiograms, and in 14 the EKG is abnormal, 9 showing evidence of past myocardial infarction. In 24 of the 32 patients the single severe narrowing was confined to the left anterior descending artery and in 15 it was above the first perforating branch of this vessel. Although all of these patients were ideal surgical candidates they also seemed to be ideal candidates for more conservative management and appeared to have an excellent prognosis. This is supported by the autopsy studies which again suggest that sudden death is extremely rare with single vessel arterial disease. In conclusion, it appears that an arteriographic pattern of coronary artery disease is a better predictor of prognosis than a clinical presentation. The groups or subsets of patients identified by coronary arteriography are more homogenous and the prognosis can be predicted possibly with greater accuracy than if the clinical parameters alone were utilized. In particular, it appears that a separate population group with severe triple vessel disease can be identified as high risk. If these people also have abnormal Q waves or ST segment or T wave changes on the resting electrocardiogram the incidence of sudden death is much higher. Retrospective autopsy studies and prospective coronary arteriographic studies both agree that sudden death from arteriosclerotic heart disease is much more common in extensive multi-vessel disease and that single vessel disease has a good prognosis.