



Pathology Biology Section - 2012

G27 A Comprehensive and Systematic Evaluation of Sudden Cardiac Death in a Diverse Urban Population

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After attending this presentation, attendees will understand the definition of sudden death and its relationship to atherosclerotic coronary artery disease. Attendees will also gain new insight into sudden death and its causes.

This presentation will impact the forensic science community by showing how the background incidence of sudden death due to coronary artery disease is decreasing and is lower than had been reported in the literature previously.

Despite decreases in overall mortality of death from cardiac causes due to better treatment and interventions over the past decade, sudden cardiac death (SCD) remains a significant public health problem in the United States. The true burden of SCD; however, remains unknown; variable definitions and inconsistent ascertainment methods in previous studies have resulted in widely divergent estimates of its incidence. The common paradigm is that sudden death is most likely cardiac (particularly due to coronary artery disease) in origin. However, commonly cited epidemiologic data on SCD are now a generation old, predate modern advancements in cardiac care, and were drawn from homogenous populations. Many relied on retrospective records review and/or death certificate review, which did not require autopsy-proven heart disease in the vast majority of cases, and may overestimate the prevalence of coronary artery disease in the community. Prior gold standard autopsy studies defining the underlying causes of SCD indicated that coronary artery disease (CAD) is the underlying cause of death in 80% of cases; however, these data are similarly outdated and hindered by referral bias of only a small subset of SCD cases. The contemporary epidemiology and pathology underlying SCD in the rapidly diversifying U.S. population is therefore unknown.

In a unique collaboration, the Cardiac Electrophysiology Section at the University of California at San Francisco and the San Francisco Office of the Chief Medical Examiner have worked to establish a robust surveillance method and comprehensive evaluation of all consecutive incident SCDs in San Francisco, a prototypic diverse U.S. community that presages near-term national demographic shifts. The population of San Francisco numbers 700,000 residents and increases to 1.5 million persons during working hours. The annual mortality rate in San Francisco is approximately 6,000 with half of these reported to the Office of the Chief Medical Examiner. Of these cases, approximately 1,400 decedents come under the jurisdiction of the Medical Examiner, including the vast majority of sudden deaths which include those dying outside of a physician's recent (within three weeks) care. The cases accepted by the office are completely investigated with review medical records, statements from witnesses, and evaluation by a American Board of Pathology certified forensic pathologist.

In this study funded by the National Institutes of Health for five years, which officially began in February 2011, all deaths reported to the office are screened by two physicians (a forensic pathologist and a cardiac electrophysiologist) for circumstances fitting World Health Organization (WHO) sudden death criteria (witnessed death within one hour or unwitnessed without symptoms 24 hours before). These cases then undergo complete investigation, including comprehensive autopsy incorporating a specially designed cardiac protocol, toxicology, and histology. The cardiac protocol includes measurements of the left ventricular compact and full thickness myocardium, and the short axis of the left ventricle at the level of the origin of the papillary muscles. Coronary artery stenoses are assessed systematically at 5mm sections, and microscopically if evidence of plaque rupture is seen. Histology is reviewed by two pathologists and assessed for degree and nature of cardiac fibrosis, as well as other pathology (i.e. myocarditis, cardiomyocyte disarray, etc.). Frozen tissue (heart, blood in EDTA tubes, and skin) is obtained and with next of kin consent, will form a genetic and molecular tissue bank for future study.

To estimate the prevalence of cardiac pathology in the general population, comprehensive autopsy evaluation of a frequency-matched sample of geographically and demographically similar accidental trauma death controls are also performed over the same period. Accidental trauma deaths are those who die with an accidental manner of death (such as falls or motor vehicle collisions) who die at the scene or shortly after transportation to the hospital. Findings from autopsy of these trauma death controls will be compared to SCDs to allow for the evaluation of CAD, other pathology, and cardiac indices (all thickness, mass) as risk factors for SCD.

As of July 2011, approximately 110 SCDs and 14 trauma controls have been evaluated in the study, representing over 85% of all SCDs occurring in San Francisco over the six months since study inception. Of these cases, approximately 40



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cases have been reviewed by two pathologists and two cardiac electrophysiologists. Approximately 40 percent of the reviewed "SCDs" so far have had non-cardiac causes of death. At the time of presentation, the study will have been performed for one year (out of a total of three years of autopsy study) and many more cases will have been reviewed with resultant information.

This novel study fulfills a critical need for the precise characterization of the contemporary epidemiology and underlying causes of sudden cardiac death in population subgroups heretofore underrepresented. These data may allow for the elucidation of new independent risk factors for sudden cardiac death and direct new insights into the clinical therapy of this lethal disease.

Sudden Death, Coronary Artery Disease, Public Health