

The following briefing outlines a scientific research project carried out in partial fulfilment of a M.Sc. Degree at the University of Malta, funded by the Tertiary Education Scholarships Scheme.

Sudden unexpected death (SUD) is a common diagnostic problem faced by the forensic histopathologist. In some cases, the autopsy findings, blood tests and patient history are often inconclusive as to the cause of death. Examination of the cardiac conduction system (CCS) in such cases might help to establish the cause of death.

The study was carried out prospectively from February 2019 to January 2021 at Mater Dei Hospital, Malta. 109 hearts from sudden cardiac and non-cardiac related cases were studied. Multiple CCS variables were analysed statistically between the studied subjects, ranging from Controls (Group I – normal hearts) to patients with severe atherosclerotic disease coupled with myocardial hypertrophy (Group V). The age factor was also analysed. Statistical tests used included Fischer's exact test, Kruskal-Wallis test and Neural network.

In our study, we found fibrosis of the SA and AV nodes in 82.5% and 45.9% of cases, respectively, and 11.7% in the His bundle. Fat deposition was observed in 48.5% and 62.2% of SA and AV nodes, respectively; 39% in the His bundle; and bundle branches in 8.26% of patients. Fibromuscular hyperplasia was noted in 25.2% of SA and 44.9% of AV nodal arteries; persistent foetal dispersion in 50% of AV nodes; and His bundle fragmentation in 79.2% of cases. Discrete inflammatory cells were seen in 8.74% and 5.11% of SA and AV nodes, respectively. Calcifications interfered directly with conduction tissue in only 2 cases (2.6%), specifically in the His bundle. Mild haemorrhage was spotted in 4.9% of SA nodes, 2% of AV nodes and 2.5% of bundle branches. The shape, dimensions and positional variations of the CCS components were amongst other variables investigated. Statistically significant variables were classified by the Neural network in terms of importance. In summary, heart size-related variables resulted as the most important, followed by atherosclerosis and age.

Although no isolated CCS abnormalities were found, we could still evaluate the importance of CCS histological examination. Apart from the CCS abnormalities and variations observed in control subjects and young individuals (< 25 years old), we managed to identify statistically significant pathological changes between the Controls and pathological groups (Group 1 through Group V), and between age groups. Two major findings in this study were: severe nodal artery hyperplasia of the SA node in a 22-year-old male; and severe fat replacement of the SA node in a 20-year-old male.

The latter findings would have remained hidden and could have shed more light on the cause of death in a negative-autopsy case, as there was no local autopsy protocol for CCS investigation until this study was carried out. In conclusion, we advise that the CCS should be investigated routinely in SUD cases, to evaluate whether any CCS abnormalities could have contributed to the morbidity and mortality of the respective patients.