A comparison of isoproterenol and epinephrine for the induction of arrhythmia during cardiac ablation procedures

Purpose

According to the American Heart Association, more the 4 million Americans suffer from recurrent arrhythmias. While many arrhythmias are successfully managed using medications alone, some arrhythmias are better managed through cardiac ablation. During an ablation procedure, the arrhythmia is induced, if needed, by using an arrhythmia-inducing medication. Historically, isoproterenol has been the induction agent of choice. However, literature also shows that some cardiologists have used epinephrine as an induction agent (Patel, 2018). While both isoproterenol and epinephrine have been accepted as appropriate induction agents, there is minimal literature comparing their outcomes. The purpose of this study is to evaluate whether isoproterenol or epinephrine is more effective in the induction of cardiac arrhythmias during electrophysiology studies.

Methods

This retrospective chart review will include 500 patients who received either isoproterenol or epinephrine for arrhythmia induction during cardiac ablation procedures within the Mercy Health System between June 2017 and June 2019. The primary outcome measure will be whether an arrhythmia was successfully induced. Secondary outcome measures will include cost of induction agent between the two groups, atropine use and its efficacy, dose of induction agent, whether patients were admitted for further management secondary to the procedure, and whether death occurred during the procedure or during admission following the procedure. Baseline characteristics to be collected include patient age, sex, length of procedure, comorbidities, and home medications by class. This study will exclude patients who did not need an induction agent and patients in whom home medications were not stopped an appropriate amount of time before the procedure. To meet power of 80%, 247 patients are needed in each group. Alpha was set at 0.05. The primary outcome measure will be statistically analyzed using the Pearson chi-square test and secondary outcomes will be analyzed using either the Pearson chi-square test or the Mann-Whitney U test.

Results

172 patient charts were included in this retrospective chart review. Of the 172 patient charts included, 106 received isoproterenol as an induction agent and 66 received epinephrine. 92.5% of the patients receiving isoproterenol and 63.6% of the patients receiving epinephrine underwent successful arrhythmia induction. Statistical analysis revealed a chi squared value of 10.57 for this study, which is statistically significant. However, this study did not meet power. A cost analysis was also conducted, which revealed that isoproterenol was estimated to cost $116.48 more per dose than epinephrine.

Discussion

While both isoproterenol and epinephrine were effective for the induction of arrhythmias, isoproterenol was more effective with fewer adverse events. Of note, data analysis revealed no instances of atropine use to induce an arrhythmia after a standard induction agent was failed. It should also be noted that the epinephrine group included patients of older age and had more comorbid conditions at baseline, which may be confounding results. If epinephrine is used rather than isoproterenol, cost savings could be significant; however, more patients in the epinephrine group were admitted to the hospital following their procedure. Therefore, further studies are needed to determine the safety of epinephrine when used as an induction agent. While power was not met for this study, the primary outcome was statistically significant. However, the risk of type I error must be considered. Study limitations include retrospective design, failure to meet power, confounding variable such as distribution of age and comorbid conditions between groups, and failure to assess long-term patient outcomes after procedure completion. The results of this study suggest that epinephrine may be appropriate for induction of arrhythmias during cardiac ablation procedures if isoproterenol is unavailable.