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Acute outcome of treating patients admitted with electrical storm in a tertiary care centre

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ARTICLE INFO

Article history:
Received 18 March 2016
Received in revised form
26 March 2016
Accepted 27 March 2016
Available online 29 March 2016

Keywords:
Electrical storm
Acute outcome

ABSTRACT

Background: Electrical storm (ES) is a life threatening emergency. There is little data available regarding acute outcome of ES.
Aims: The study aimed to analyze the acute outcome of ES, various treatment modalities used, and the factors associated with mortality.
Methods: This is a retrospective observational study involving patients admitted with ES at our centre between 1/1/2007 and 31/12/2013.
Results: 41 patients (mean age 54.61 ± 12.41 years; 86.7% males; mean ejection fraction (EF) 44.51 ± 16.48%) underwent treatment for ES. Hypokalemia (14.63%) and acute coronary syndrome (ACS) (14.63%) were the commonest identifiable triggers. Only 9 (21.95%) patients already had an ICD implanted. Apart from antiarrhythmic drugs (100%), deep sedation (87.8%), mechanical ventilation (24.39%) and neuraxial modulation using left sympathetic cardiac denervation (21.95%) were the common treatment modalities used. Thirty-three (80.49%) patients could be discharged after a mean duration of 14.2 ± 2.31 days. Eight (19.5%) patients died in hospital. The mortality was significantly higher in those with EF < 35% compared to those with a higher EF (8 (42.11% vs 0 (0%), p = 0.03)). There was no significant difference in mortality between those with versus without a structural heart disease (8 (21.1% vs 0 (0%), p = 0.32)). Comparison of mortality an ACS with ES versus ES of other aetiologies (3 (50%) vs 5 (14.29) %, p = 0.076)) showed a trend towards significance.
Conclusion: With comprehensive treatment, there is reasonable acute survival rate of ES. Hypokalemia and ACS are the commonest triggers of ES. Patients with low EF and ACS have higher mortality.

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Peer review under responsibility of Indian Heart Rhythm Society.
http://dx.doi.org/10.1016/j.ipej.2016.03.002

Introduction

Acute Electrical storm (ES) is a life threatening emergency and carries a significant risk of mortality. There is little data regarding acute outcome of ES [1], especially from the developing world. Similarly, less is known on ES occurring in patients who have not undergone an implantable cardioverter defibrillator (ICD) placement, since most of the studies pertaining to ES are confined to patients with ICDs [2–4]. The present study is a single center experience of treating patients with acute ES irrespective of ICD implantation, focusing on the treatment modalities used, outcome and the factors associated with mortality.

Objectives

Primary aim of the study was to analyze the acute outcome of ES, whereas the secondary aim was to analyze the various treatment modalities used, and the factors associated with increased mortality.

Methods

This is a retrospective observational study involving patients with Electrical storm, between 1/1/2007 and 31/12/2013, at Sree Chitra Tirunal Institute for Medical sciences and Technology (SCTIMST). The demographic parameters, the treatment modalities used, and the acute outcome were analyzed. Subjects were retrospectively recruited based on the Hospital Medical records. The electrocardiogram (ECG) and/or ICD-electrograms (EGMs) (for patients with ICD) were used to diagnosis and delineate the details of the ventricular arrhythmia (VA). Whenever ICD-EGMs were used rate, morphology, stability, onset and AV dissociation were used to discriminate VT from supraventricular arrhythmias. All patients who were admitted for treatment of ES were included in the study. Those with ES occurring within 1 week of ICD implantation were excluded as ES is known to be triggered during this period. Patients were also excluded if the available data was incomplete.

Definitions

Electrical storm (ES)

Recurrent ventricular arrhythmias (VA) in a short time (≥3 separate episodes in 24 hrs, each requiring termination by intervention) or frequent defibrillator therapies (≥3 separate discrete episodes of VAs, separated by more than 5 min in 24 hrs) or incessant VA (continuous VA that recurred promptly despite intervention for termination over 12 hrs) [4,5].

Cessation of ES

ES was considered to be ceased after at least a 7 day-period free of recurrent VAs.

Ventricular tachycardia (VT)

VT was diagnosed by the standard ECG when available. When Electrocardiographic (ECG) record of the VA could be obtained, VF and polymorphic VT were diagnosed based on QRS morphologies. When electrograms from ICDs (EGMs) alone were available, VAs with <30 ms cycle length (CL) variation were considered monomorphic, while those with CL variation >30 ms were regarded as polymorphic [6].

Ventricular fibrillation (VF)

Electrocardiographic documentation of VF, or any VA of rate >250/min with varying cycle length when ICD electrograms alone were available.

Structural heart disease (SHD)

Was defined, for the purpose of this study, as diseases with echocardiographically detectable abnormality.

Statistical analysis

All the quantitative data are reported as mean ± S.D. Qualitative data are expressed as proportions. All the analyses were done using the SPSS 16 software. Fischer exact test was used for comparison of categorical data.

Results

The baseline parameters of the patients are shown in Table 1 The mean age was 54.61 ± 12.41 years and 31 (86.7%) were males. The mean ejection fraction (EF) was 44.51 ± 16.48%. The aetiological distribution of the patients is shown in Fig. 1. Coronary artery disease was the commonest underlying disease. The mean number of VAs per ES episode was 11.15 ± 15.48 and the mean rate of VA during ES was 179.46 ± 69.46. The morphology of VA during the ES was RBBB 18 (43.9%), LBBB 12 (29.27%), Polymorphic/VF 8 (19.51%), ICD EGM alone in 3 (7.31%). Though a clear triggering factor could not be identified in the majority (60.97%), Hypokalemia (14.63%) and acute coronary syndrome (ACS) (14.63%) remained the commonest identifiable triggers that precipitated an ES. The mean potassium level was 2.8 ± 0.22 mEq/dL in those having hypokalemia. In a patient with Brugada syndrome, fever precipitated the ES and he was treated with paracetamol, tepid sponging and Isoprenaline infusion. Only 9 (21.95%) patients had an ICD implanted before the occurrence of ES. The appropriate ICD intervention during the ES was shock alone in 3 (33.3%), and Anti Tachycardia Pacing (ATP) with Shock in 6 (66.6%) of the patients.

Modalities used in treating ES (Table 2)

The various treatment modalities used in the management of ES are shown in Table 2. Apart from antiarrhythmic drugs which were invariably used, 36 (87.8%) patients underwent deep sedation and 10 (24.39%) underwent mechanical