Conduction Abnormalities: Types, Associated Factors and Their Effect on Clinical Outcomes of Patients Admitted to the Coronary Care Unit at King Abdulaziz University Hospital

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ABSTRACT

Background: Since conduction abnormalities represent a major cause of sudden death and cardiovascular complications, with a high incidence of increased length of hospital stay, risk of disabilities and healthcare costs, the aim was to discern the influence of conduction abnormalities at the time of admission on the clinical outcomes of patients admitted at the Coronary Care Unit in King Abdulaziz University Hospital.

Method: The study adopted a retrospective-record review, episode-based design for a period of 2 years. All patients with sustained conduction abnormalities at the time of admission that had either self-terminated or required intervention were recruited. Statistical analysis was conducted by SPSS.

Results: A total of 1763 admissions occurred during the study period, conduction abnormalities represented 11.5% of all these cases. The most common types were the left bundle branch block and atrial fibrillation. Types that were significantly associated with the length of stay were atrial fibrillation (P = 0.045), ventricular tachycardia (P = 0.020), and ventricular fibrillation (P = 0.007) and complete heart block (P = 0.004). Right bundle branch block was the only conduction abnormality that was significantly associated with higher mortality (P = 0.011).

Conclusion: Patients with right bundle branch block need close monitoring and optimal care to reduce risks of increased hospital stay and death. Further, it is imperative that attention should be directed in general to all patients admitted to the coronary care unit with any kind of conduction abnormality in order to attempt to reduce their stay.

Keywords
Conduction abnormalities; Arrhythmia; Coronary care unit; Atrial fibrillation

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INTRODUCTION

Conduction abnormalities are generally defined as the loss of normal rhythm of the heart, so-called normal sinus rhythm. They are significantly associated with increased risks of cardiovascular complications and sudden death, consequently leading to decreased quality of life, disability, high mortality, and healthcare expense[11].

Continuous electrocardiograph monitoring is utilized in the Coronary Care Units (CCUs) to identify cardiac conduction abnormalities and to illustrate the morphology of electrocardiographic waves and tracts[12]. The role of CCUs had significantly increased as these abnormalities represent common clinical events in these settings[13-18]. Conduction abnormalities complicating cardiac events were commonly reported to be associated with significantly worse prognosis[9-13], as they represent a major cause of sudden death and cardiovascular complications, with a high incidence of increased length of hospital stay, risk of disabilities and healthcare costs[11].

Another study investigated the incidence among 215 patients admitted in the medical intensive care units (ICUs) in the Caribbean Islands University in 2016, reporting a prevalence of 49.3%[14].

While they are considered to be frequently encountered events in the critical care setting, mostly serving as an indication of disease severity and a predictor of prognosis[15], the outcomes and sequels of conduction abnormalities when they are presented at the time of admission to the CCU hadn’t been widely investigated. This paper investigated the association between conduction abnormalities at the time of admission and the clinical outcome of these patients, and the possibility of using these abnormalities as predictors of prognosis in the CCU.

The aim of this study was to identify the types and factors associated with conduction abnormalities, and their influence on the clinical outcomes of patients admitted at the CCU in King Abdulaziz University Hospital.

MATERIALS AND METHODS

The study adopted a retrospective record review of an episode-based design that included 1763 admissions over a two year-period.

Special emphasis was given to the patients having conduction abnormalities at the time of admission to predict the clinical outcome at the Coronary Care Unit at King-Abdulaziz University Hospital. Included were all patients with sustained conduction abnormalities at the time of admission that had either self-terminated or required intervention.

Data was collected from the hospital’s Phoenix electronic system using International Classification of Disease-10 (ICD-10), and from the patients’ paper-based records.

Standardized data collection sheet was constructed and tested for validity and reliability; it collected the following data: Personal data, smoking habits, presenting symptoms, established diagnosis, presence of conduction defects, their types with ECG findings and the length of hospital stay. The following defects were included: a) Monomorphic or polymorphic wide QRS tachycardia that were self-terminated or required medical or electrical termination; b) Narrow-QRS tachycardia such as atrial flutter or fibrillation, atrial tachycardia, and other narrow-QRS tachycardia usually classified as supraventricular, including chronic tachycardia atrial fibrillation (AF) present before admission to the CCU; c) Delayed or blocked electrical pulse within the AV node, bundle of His or the Purkinje system including: first degree heart block, second degree heart block type I and II, third degree heart block and bundle branch block.

Episodes of arrhythmias that were developed during the CCU stay were excluded. Also excluded were patients with significantly missed/incomplete data in the records. The 12-lead electrocardiography was virtually performed for all patients. Conduction abnormalities were diagnosed by experienced Cardiologists.

In King Abdulaziz University Hospital, a single scale rounded up to the highest 0.1 kilogram (kg) was used to obtain weight values. While for height, a mechanical beam scale with a height rod was used with measurements rounded up to the nearest centimeter (cm).

STATISTICAL ANALYSIS

Data was analyzed by the IBM SPSS Statistics for Windows, Version 20 (IBM Corp., Armonk, NY USA) Body mass index was calculated (weight / height²). Demographic variables and underlying clinical conditions of patients with AF, atrial flutter, supraventricular tachycardia, ventricular tachycardia (VT), ventricular fibrillation (VF) and other types of conduction abnormalities at admission were presented as mean ± SD for age and frequencies and percentages for categorical variables. Descriptive statistics were used to calculate frequencies of cardiac arrhythmia and heart block. Chi-squared test was used to find the association between different types of conduction abnormalities, the length of CCU stay and mortality.

RESULTS

A total of 1763 admission files were scrutinized during the study period. The mean age of all patients admitted to CCU was 57.49 ± 16.85 years. About three-fourths (75.6%) of the patients were male. Most of the patients were of non-Saudi nationality (69.4%). In addition, 20.0% of all patients were current smokers.

A total of 204 patients were identified to have a sort of conduction defect at the time of admission to the CCU and met the inclusion criteria. They represented 11.6% of all patients admitted to CCU.
Among all types of defect, the left bundle branch block was the most common type and represented 26.96% of all arrhythmias. The second most common type was AF at a percentage of 21.07% of cases of arrhythmias. The least commonly reported defect was VF in only 2 patients (0.98%) (Fig. 1).

There was a preponderance of arrhythmia among males (66.7%) compared to females (33.3%). A highly significant statistical difference was present ($P = 0.002$). The highest percentage of defects occurred among the population of ages 50-70 years ($P = 0.002$). The majority of patients with conduction abnormalities were overweight and obese. However, there is no statistically significant difference ($P = 0.08$). Table 1 illustrates the relationship between socio-demographic factors and the presence of conduction defects.

Conduction abnormalities that were significantly associated with the length of stay were AF ($P = 0.045$), VT ($P = 0.020$), and VF ($P = 0.007$) and complete heart block ($P = 0.004$). Right bundle branch block was the only conduction abnormality that was significantly associated with higher mortality ($P = 0.011$). The results are outlined in more detail in Table 2.

![FIGURE 1](image-url)

### FIGURE 1.
Frequency of different types of conduction abnormalities at the time of admission among patients presented by it and admitted to the coronary care unit.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Number of Patients (%)</th>
<th>Patients With Arrhythmia or Heart Block at the Time of Admission (n = 204)</th>
<th>Patients Without Arrhythmia or Heart Block at the Time of Admission (n = 1559)</th>
<th>$P$-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (mean ± SD)</td>
<td>57.48 ± 16.58</td>
<td>59.71 ± 15.26</td>
<td>57.19 ± 17.03</td>
<td>0.003</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>1332 (75.6)</td>
<td>136 (66.7)</td>
<td>1196 (76.7)</td>
<td>0.002</td>
</tr>
<tr>
<td>Female</td>
<td>431 (24.4)</td>
<td>68 (33.3)</td>
<td>363 (23.3)</td>
<td></td>
</tr>
<tr>
<td>Nationality</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Saudi</td>
<td>539 (33.6)</td>
<td>70 (34.3)</td>
<td>469 (30.1)</td>
<td>0.226</td>
</tr>
<tr>
<td>Non-Saudi</td>
<td>1224 (69.4)</td>
<td>134 (65.7)</td>
<td>1090 (69.9)</td>
<td></td>
</tr>
<tr>
<td>Age (n=1734)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21-</td>
<td>473 (27.3)</td>
<td>46 (23.0)</td>
<td>427 (27.8)</td>
<td>0.00</td>
</tr>
<tr>
<td>50-</td>
<td>964 (55.6)</td>
<td>91 (45.5)</td>
<td>873 (56.9)</td>
<td></td>
</tr>
<tr>
<td>≥ 70</td>
<td>297 (17.1)</td>
<td>63 (31.5)</td>
<td>234 (15.3)</td>
<td></td>
</tr>
<tr>
<td>Body Mass Index (n=1762)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Underweight</td>
<td>65 (3.7)</td>
<td>4 (1.9)</td>
<td>61 (3.9)</td>
<td>0.08</td>
</tr>
<tr>
<td>Normal</td>
<td>518 (29.4)</td>
<td>53 (25.1)</td>
<td>465 (30.0)</td>
<td></td>
</tr>
<tr>
<td>Overweight and Obese</td>
<td>1179 (66.9)</td>
<td>154 (73.0)</td>
<td>1025 (66.1)</td>
<td></td>
</tr>
<tr>
<td>Current Smoker</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>353 (20.1)</td>
<td>29 (14.4)</td>
<td>324 (20.8)</td>
<td>0.067</td>
</tr>
<tr>
<td>No</td>
<td>1067 (60.9)</td>
<td>136 (67.3)</td>
<td>931 (60.0)</td>
<td></td>
</tr>
<tr>
<td>Former</td>
<td>333 (19.0)</td>
<td>37 (18.3)</td>
<td>296 (19.2)</td>
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</tr>
<tr>
<td>Illicit Drug Use</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>21 (1.2)</td>
<td>4 (2.0)</td>
<td>17 (1.1)</td>
<td>0.279</td>
</tr>
<tr>
<td>No</td>
<td>1742 (98.8)</td>
<td>200 (98)</td>
<td>1542 (98.9)</td>
<td></td>
</tr>
</tbody>
</table>

### TABLE 1.
Comparison between the baseline characteristics of patients with conduction abnormalities, and those without, at the time of admission to the coronary care unit.
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TABLE 2.
Frequencies and percentages of cardiac arrhythmias and heart block on admission, and their relationship with length of stay in hospital

<table>
<thead>
<tr>
<th>Arrhythmia or Heart Block on Admission</th>
<th>N</th>
<th>%</th>
<th>N</th>
<th>%</th>
<th>N</th>
<th>%</th>
<th>N</th>
<th>%</th>
<th>N</th>
<th>%</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atrial Fibrillation</td>
<td>13</td>
<td>0.74</td>
<td>16</td>
<td>0.91</td>
<td>5</td>
<td>0.28</td>
<td>3</td>
<td>0.17</td>
<td>6</td>
<td>0.34</td>
<td>0.041</td>
</tr>
<tr>
<td>Atrial Flutter</td>
<td>3</td>
<td>0.17</td>
<td>1</td>
<td>0.06</td>
<td>0</td>
<td>0.00</td>
<td>1</td>
<td>0.06</td>
<td>3</td>
<td>0.17</td>
<td>0.059</td>
</tr>
<tr>
<td>Supraventricular Tachycardia</td>
<td>9</td>
<td>0.51</td>
<td>4</td>
<td>0.23</td>
<td>0</td>
<td>0.00</td>
<td>0</td>
<td>0.00</td>
<td>1</td>
<td>0.06</td>
<td>0.481</td>
</tr>
<tr>
<td>Ventricular Tachycardia</td>
<td>4</td>
<td>0.23</td>
<td>3</td>
<td>0.17</td>
<td>1</td>
<td>0.06</td>
<td>3</td>
<td>0.17</td>
<td>3</td>
<td>0.17</td>
<td>0.020</td>
</tr>
<tr>
<td>Ventricular Fibrillation</td>
<td>0</td>
<td>0.00</td>
<td>0</td>
<td>0.00</td>
<td>0</td>
<td>0.00</td>
<td>2</td>
<td>0.11</td>
<td>0</td>
<td>0.00</td>
<td>0.007</td>
</tr>
<tr>
<td>Premature Ventricular Contractions</td>
<td>2</td>
<td>0.11</td>
<td>2</td>
<td>0.11</td>
<td>0</td>
<td>0.00</td>
<td>1</td>
<td>0.06</td>
<td>0</td>
<td>0.00</td>
<td>0.423</td>
</tr>
<tr>
<td>1st Degree Heart Block</td>
<td>9</td>
<td>0.51</td>
<td>2</td>
<td>0.11</td>
<td>2</td>
<td>0.11</td>
<td>1</td>
<td>0.06</td>
<td>2</td>
<td>0.11</td>
<td>0.459</td>
</tr>
<tr>
<td>2nd Degree Heart Block</td>
<td>1</td>
<td>0.06</td>
<td>1</td>
<td>0.06</td>
<td>0</td>
<td>0.00</td>
<td>1</td>
<td>0.06</td>
<td>1</td>
<td>0.06</td>
<td>0.300</td>
</tr>
<tr>
<td>3rd Degree Heart Block</td>
<td>3</td>
<td>0.17</td>
<td>8</td>
<td>0.45</td>
<td>5</td>
<td>0.28</td>
<td>2</td>
<td>0.11</td>
<td>2</td>
<td>0.11</td>
<td>0.004</td>
</tr>
<tr>
<td>Right Bundle Branch Block</td>
<td>13</td>
<td>0.74</td>
<td>15</td>
<td>0.85</td>
<td>3</td>
<td>0.17</td>
<td>1</td>
<td>0.06</td>
<td>5</td>
<td>0.28</td>
<td>0.238</td>
</tr>
<tr>
<td>Left Bundle Branch Block</td>
<td>31</td>
<td>1.76</td>
<td>16</td>
<td>0.91</td>
<td>4</td>
<td>0.23</td>
<td>2</td>
<td>0.11</td>
<td>2</td>
<td>0.11</td>
<td>0.815</td>
</tr>
</tbody>
</table>

Total number of deaths that occurred among conduction abnormalities population was 8, it was reported in the following types; one patient admitted with supraventricular tachycardia (P = 0.350), one patient with 2nd degree heart block (P = 0.082), two patients with 3rd degree heart block (P = 0.012), and four patients admitted with RBBB (P = 0.011). The main cause of death in most of these patients was cardiogenic shock. One patient admitted with RBBB passed away during ventricular septal defect repair following extensive anterior myocardial infarction.

DISCUSSION

This single-center study aimed to investigate the association of each conduction abnormality at admission individually with mortality and length of hospital stay within the CCU. The clinical impact of conduction disorders on the critical cases in the literature is uncertain, and data in medical ICU is lacking[16]. In this study, conduction abnormalities occurred among 11.5% of patients who attended the CCU at the time of admission in the hospital. A prospective study done in the University of Vienna reported that the incidence of cardiac arrhythmias in surgical and medical intensive care units were 15.7% and 19.7 %, respectively[3].

AF is considered one of the most commonly sustained arrhythmias in clinical practice[16]. The ability to correctly assess patients and stratify them based on the risk for prolonged and complicated hospitalization indubitably guides the expectations of patients, clinicians, administrators and even reimbursement policies[18]. A longer length of stay is associated with increased hospital costs, lower performance on quality of care measures, and higher rates of subsequent readmissions and mortality[18]. Other conduction abnormalities that had also shown significant association with length of stay in this study included VT, VF and third degree heart block with mean length of stay 1.5 days (P = 0.020), 7.5 days (P = 0.007), 3.5 days (P = 0.004), respectively.

The only conduction abnormality that had been associated with mortality in this study was the RBBB with a p value of 0.011. Most of the literature revolving around the knowledge of RBBB and mortality is based on a few studies that were not inclusive of all demographic data and were restricted to the male gender and specific age groups[19]. Even then, RBBB has been associated with an increased mortality in patients with co-morbid cardiovascular conditions with a special emphasis on heart failure patients[20,21]. One study showed that the presence of RBBB or complete AV block at the time of admission to receive thrombolytic therapy for acute myocardial infarction is the second strongest independent predictor of adverse outcome in these patients and it even leads to a threefold increase in mortality during a 1-year follow-up[22]. Another study has established that RBBB is generally associated with all-cause mortality even in asymptomatic individuals for whom their poorer prognosis cannot be attributed to coexisting cardiovascular conditions. This has been quantified to a percentage of 30% total increase in...
the mortality risk accompanying the incidence of RBBB in individuals with no prior cardiovascular co-morbidities[10].

**CONCLUSION:**
In conclusion, the authors emphasize the entailing threat accompanying patients admitted to the CCU with RBBB, as death is more likely in this population. They need close monitoring and optimal care to reduce risks of increased hospital stay and death, besides emphasizing the imperative that attention must be directed in general to all patients admitted to the CCU with any kind of conduction abnormality in order to attempt to reduce their stay.

**LIMITATIONS AND RECOMMENDATIONS**
The retrospective nature of the study didn’t allow the full comprehension of the main cause of deterioration or improvement in many cases, besides the problem of missing data and ECGs that comprised a major limitation.

The authors call for future research to study the different factors that act in contribution to the clinical outcome of patients who are admitted into the CCU with conduction abnormalities.

**Conflict of Interest**
The authors declare that there is no conflict of interest regarding the publication of this paper.

**Disclosure**
The authors did not receive any type of commercial support either in the form of compensation or finances for this study. The authors have no financial interest in any of the products devices, or drugs mentioned in this article.

**Ethical Approval**
An approval from the Institutional Review Board of the Faculty of Medicine, King Abdulaziz University was obtained with a Reference Number of 93-16. The study was conformed to the Declaration of Helsinki Ethical Standards.

**Consent to Participate**
All patients signed an informed written consent for possible contribution to research (collecting and publishing data) at the time of admission as per hospital’s protocol.

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**REFERENCES**


خلال توصيل نبضات القلب: أنواعها والمواد المرتبطة بها، وتأثيرها على النتائج السريرية للمرضى الذين ادخلوا إلى وحدة العناية بالشرايين التاجية في مستشفى جامعة الملك عبد العزيز

نهاية خميس (إبراهيم) 1،2، وليد الغلابي 3، أسماء عادل الملالي 3، أفانس محمد نيار 3، مجدي فاضل 3

التركستاني 4، ورهف هشام نيازي 4

قسم طب المجتمع، قسم الطب الباطني، كلية الطب، جامعة الملك عبد العزيز.

جامعة الملك عبد العزيز، جامعة الأسمنتية - جمهورية مصر العربية.

المستخلص:

مقدمة: تعتبر اضطرابات نبضات القلب مصدرًا رئيسيًا لمضاعفات أمراض القلب والأوعية الدموية والمكوث المفاجئ، وإطالة مدة الإقامة في المستشفى والجزء البدني، أضاف إلى ذلك زيادة نتائج الرعاية الصحية، والهدف من هذه الدراسة معرفة تأثير هذه الاضطرابات عند وجودها، أثناء الدخول إلى وحدة الرعاية التاجية في مستشفى جامعة الملك عبد العزيز على النتائج السريرية لهؤلاء المرضى.

منهج الدراسة: هذه الدراسة هي استدلالية وتم التركيز فيها على المرضى الذين يعانون من خلل في نظام التوصيل الكهربائي في القلب أثناء الدخول للوحدة خلال ستين.

ملخص النتائج: كان أكثر أنواع الاضطرابات شيوعًا بين 1763 مريض هو إحصار فرع الخزيمة الأيسر، ثم الرفجان الأذيني، أما أنواع الاضطرابات التي ارتبطت بشكل كبير مع طول الإقامة في المستشفى فكانت الرفجان الأذيني (20045 = P)، تشريع دقات البطين (2007 = P) والرفجان البطيني (20047 = P) وإحصار القلب (20011 = P).

الخلاصة وأهم التوصيات: يجب التأكيد على أن مرضى إحصار الخزيمة اليمنى المتواجدون في وحدة العناية التاجية أكثر عرضة لحالات الوفاة من غيرهم، وكذلك الاهتمام بالمرضى، وحده العناية التاجية، وكذلك في نمط التوصيل الكهربائي للفتب من أجل تحسين قابلتهم في المستشفى، كما تطلع للبحث مستقبلا حول دراسة العوامل المختلفة التي تساهم وتوتر على مخرجات خلل نظام التوصيل الكهربائي للقلب في وحدة العناية بالشرايين التاجية.