The Diagnostic Agreement of Original and Faxed Copies of Electrocardiograms

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Introduction

Every day a great number of patients refer to general practitioners in remote and rural areas due to different complaints related to cardiovascular diseases. Electrocardiogram (ECG) is one of the diagnostic tools in cardiovascular diseases and most general physicians working in rural areas have access to electrocardiograph device and use it frequently, but sometimes interpretation of electrocardiographic images is difficult and requires consultation with a specialist.

In many countries around the world, telemedicine is used to provide medical services for people living in deprived areas. For example, according to a 9-year study in Italy, approximately 27,000 medical teleconsultations had been performed [1]. In a structured review on telecardiology by Hailey et al (2005), positive results have been observed [2]. But implementation of a telecardiology system requires highly specialized communication technology and a broadband internet [2, 3].

It seems that instead of using advanced expensive systems for the transmission of electrocardiographic images, more cost-effective and practical systems can be used [3]. In Iran, most clinics are facilitated with electrocardiogram device, phone line and fax machine. Therefore, general practitioners working in these areas can record patients’ electrocardiogram, divided it into pieces and stick them on an A paper, send it by fax to a specialist and get the result via phone call. The aim of this study was to find the agreement between diagnoses made by reading the original electrocardiographic images and the copied versions transmitted via fax.

Materials and Methods

This cross-sectional study was performed during the spring and summer of 2011. First, 60 original electrocardiographic images recorded from patients hospitalized in the Cardiology wards of two hospitals affiliated to Kerman University of Medical Sciences were collected. Sample volume was determined by a biostatistics specialist and electrocardiograms were randomly extracted from patients’ files after obtaining the permission from wards chiefs. The electrocardiograms were previously cut into pieces, stuck on an A paper and put in patients’ files by nurses. It should be mentioned that electrocardiographic images belonged to patients who had been under the control of different cardiologists.

The selected electrocardiographic images were given to a faculty member of Kerman University of Medical Sciences with cardiology subspecialty certificate and he was asked to put his diagnosis on each electrocardiogram and determine whether it is normal or not and whether any therapeutic intervention or referral is needed.

Then, the electrocardiograms were transmitted via an ordinary fax machine to the same ward in the hospital and...
the faxed copies were collected. After 30 days, being
to 30 days, being insured that the cardiologist has forgotten the primary
diagnoses, they were given to him to put his diagnosis
again. Data were analyzed through SPSS-18 and using
Kappa agreement test.

Results

Electrocardiograms belonged to 60 patients (3 males and
17 females) with mean age of 62±5 years. According to
the obtained results, the diagnostic agreement of the
diagnostic agreement of the original electrocardiograms and faxed copies was very
high and approximately 96%. In fact, only in one case
from 60 cases the two diagnoses were different and 59
ones had exactly the same diagnosis in the two trials
(Table 1).

Table 1. Compared identify according to original ECG and faxed ECG to
calculate kappa agreement coefficients

<table>
<thead>
<tr>
<th>The Fax ECG</th>
<th>Normal</th>
<th>Abnormal</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Original ECG Normal</td>
<td>38</td>
<td>1</td>
<td>39</td>
</tr>
<tr>
<td>Abnormal</td>
<td>0</td>
<td>21</td>
<td>21</td>
</tr>
<tr>
<td>Total</td>
<td>38</td>
<td>22</td>
<td>60</td>
</tr>
</tbody>
</table>

Kappa Agreement = 0.0964  \( p=0.0001 \)

Discussion

Based on the results of this study, physicians working in
the deprived areas and also health guardians of the society
can be assured of transferring electrocardiograms via
ordinary fax machines to specialists for consultation
purposes as a practical measure. This is against the belief
saying that using telemedicine for patients in deprived
areas is expensive and not practical.

The present study aimed to answer whether general
practitioners could be recommended to fax the
electrocardiographic images to specialists for consultation
purposes or not? In order to answer this question, first it
was necessary to prove that the quality of
electrocardiographic images faxed via ordinary
inexpensive machines is as good to lead the specialist to
the correct diagnosis; In other words, it was important to
show that there is no significant difference between the
quality of the original image and its faxed copy.

Thousands of physicians working in deprived areas
should visit patients with cardiovascular diseases every
day and sometimes these cases are very urgent and time
has an essential role in saving these patients lives.
According to the present study, by using a very simple
practical and inexpensive way, a telecardiology system
for cardiovascular consultation can be implemented. This
system, provided that be supported by university and state
centers, could play an essential role in improving the
quality of health care services. There has been already no
study about using fax for transmission of
electrocardiographic images and only Bertazzoni et al in
Italy have performed a study on transmission of ECG
signals and receiving their copies. In the mentioned study,
0 centers that did not have any electrocardiologist or
electrocardiology facilities were selected and facilitated
with cardiophone and fax machine. They transmitted ECG
signals and received their copies. From a total of 807
transmitted cases, 3% were normal and 57% were
suspicious of urgent states. Among suspicious cases, in
25% the presence of one abnormality was confirmed [5].
In a study entitled The telecardiology revolution by
Backman et al, telecardiology services project in north
west of England was successful and telecardiology could
fill the gap between primary and secondary cares [1].

Authors’ Contributions
All authors had equal role in design, work, statistical
analysis and manuscript writing.

Conflict of Interest
No conflict.

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