

Artifacts in electrocardiogram interpreted as cardiac arrhythmias: Reports of clinical cases

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Abstract:

Background: Artifact waves in the ECG and Holter recording are not rare in clinical practice and can be mistaken for tachyarrhythmia.

Objective: To orient the practicing physicians to differentiate these artifacts from cardiac arrhythmias.

Patients and Methods: Thirteen patients with incorrectly diagnosed cardiac arrhythmias by ECG or Holter recording then distinguished to be ECG artifacts were included in this study. The patients were collected from the author's private practice in the northern Iraqi governorate of Sulaimanya during the period from June 2015 to August 2020. The differentiation of the artifact waves from the arrhythmias were made by careful inspection of the ECG, identification of the R waves within the artifact waves and correlating the artifact waves with the patient's symptoms.

Results: The artifacts were mistaken for ventricular fibrillation in two patients, ventricular tachycardia in four, atrial fibrillation in two, atrial flutter in four, and in one patient bradycardia of high grade atrio-ventricular block.

Conclusion: Distinguishing artifact in ECG and differentiating them from cardiac arrhythmia is important to avoid mismanagement.

Keywords: Electrocardiography, Arrhythmias, Artifact.

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Introduction:

The artifacts in the ECG are occasionally seen in clinical practice and can be easily mistaken as cardiac arrhythmia and sometimes treated as such which exposes the patient to serious mismanagement.¹⁻⁴ Recognizing these artifacts can be appreciated in the majority of cases but sometimes they are not recognized and considered as ventricular fibrillation (VF), ventricular tachycardia (VT)⁵⁻⁷, supraventricular tachycardia (SVT)⁸, atrial fibrillation (A fib) or atrial flutter (A fl)^{9,10,11} and rarely bradyarrhythmias like high grade atrio-ventricular block (AVB). Differentiating these artifacts from the P, QRS and T-wave of the sinus beats is very essential to avoid this confusion with arrhythmias and to set up a management strategy accordingly.¹⁻⁹ The more the physician becomes familiar with the ECG features of these artifacts, the easier it becomes for him to distinguish them and avoids confusing them with cardiac arrhythmias. Case reports of artifacts interpreted as A fib or A fl are seen in patient with muscle tremors⁸, Parkinson disease⁹, fractured arm¹¹ and many other situations^{12, 13}.

Patients and Methods:

The cases in this report were collected from the author's private clinic in the northern Iraqi governorate of Sulaimanya within the period from June 2015-August 2020. They were either referred from other physicians for assessment of palpitation or Careful inspection of the all leads of the ECG Precise

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identifications of the R wave of the sinus Self-referral. Cases which may be confused ECG artifact as cardiac arrhythmias are noticed, differentiated and recognized as artifact through:

beats within the artifact waves Reconsidering the general and cardiac clinical status of the patient including symptomatology during the ECG recording of the presumed arrhythmia and specifically looking for any hand tremor, shivering, muscles twitching or technical faults which can be responsible for the artifact waves. Identifying the R or S within the artifact waves was done by the author and confirmed by a second observer. The ECG machine used was (FX-8322, Fukuda Denshi, Tokyo, Japan), and the Holter was (Contec TLC5000, Contec medical systems, Quinhuang, China). Simple statistical methods were used to calculate the percentage of each misinterpreted diagnosis.

Results:

Thirteen patients were collected during the period of the study. These patients had misinterpreted artifacts as arrhythmias seen during the author's practice. There were nine males and four females, with an age range of 26 – 75 years. In our series of 13 patients we encountered Parkinson and non-Parkinson tremor in four patients, shivering in three, muscle twitching in four and technical faults in two. Among the 13 patients included in this report, four cases were misinterpreted as A fl, two as VF, four as VT and two as A fib. One case was misinterpreted as bradyarrhythmia of high grade Atrio-ventricular

block in A fib patient. The causes of the artifact are shown in Table1.

Table 1: Distribution of the cases by the misinterpreted diagnosis, and the causes of the artifact

Misinterpreted diagnosis	Number	%	Cause of artifacts
VT	4	31	Shivering, Hand tremor and Parkinson's
VF	2	15	Electrodes artifact
A fib	2	15	Shivering
A fl	4	31	Hand tremor
High grade AV block	1	8	Electrodes artifact

The five selected tracings depicted below show the incorrect diagnosis of VF, VT, SVT, A fib, A fl and a long pause of AVB which have been confused for ECG artifacts. The Figures 1-5 are self-explanatory. Figure 1 shows a 12 leads ECG of a 28 year old male who presented with febrile illness and shivering. He was incorrectly diagnosed as VF and DC shock was intended to be delivered. A careful evaluation of the clinical status helped to detect the artifact by looking carefully at Lead III of the trace where no many artifact waves were seen and the QRS were clearly observed in leads V4 & V5 the R waves seen within the artifacts (stars). After the shivering had settled down a residue of the artifact was seen at the beginning of the trace (right) more in leads I - aVF and V1 but not in lead III.



Figure 1: Shivering misinterpreted as VF in a 12 lead ECG

Figure 2 shows a tracing of a 65 year old patient who is a known Parkinson disease. The case was diagnosed as VT and a DC-Shock was intended to be delivered. It was promptly cancelled after careful inspection of leads aVL and V2 where P QRS T segments of the sinus rhythm were clearly seen within the artifacts.

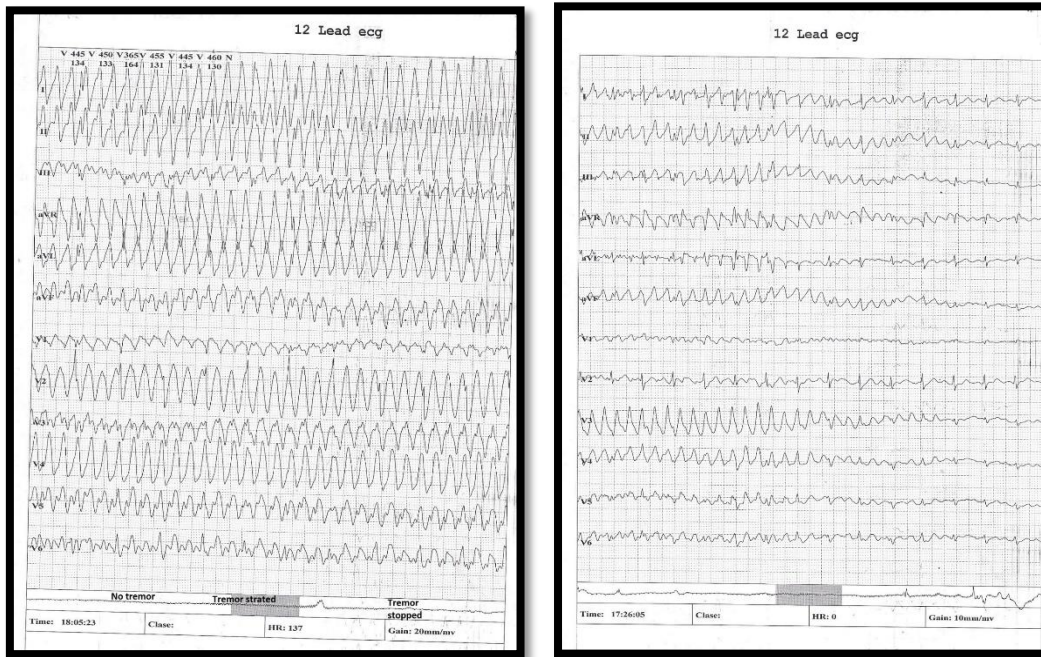


Figure 2: A 12 lead ECG of a case of Parkinsonism misdiagnosed as VT

Figure 3 shows the ECG of a 67 y old female with unexplained palpitation. Electrophysiological study (EPS) suddenly showed polymorphic VT like waves or A flutter coarse waves, the R wave can be clearly seen at lead V4 (stars) within the artifact waves, patient noticed to have hand tremor.

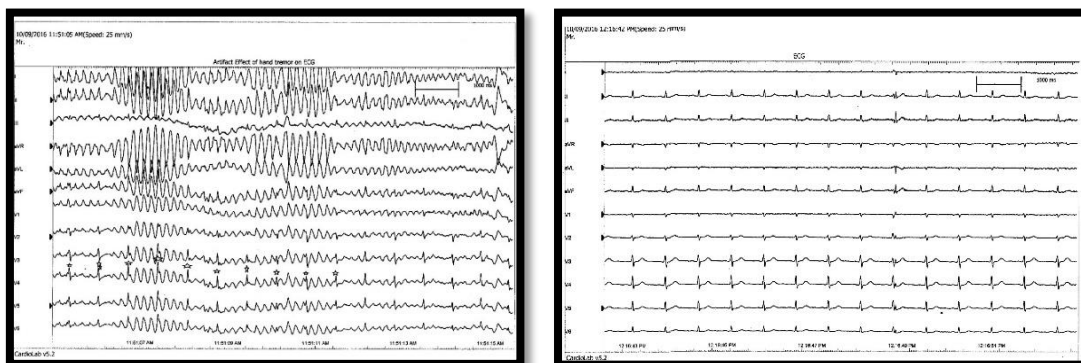


Figure 3: Hand tremor misinterpreted as VT

Figure 4 shows in the top trace a continuous single lead ECG of a 65 y old female with persistent A fib who had a synchronized DC-shock to cardiovert her into sinus rhythm. This was decided after a full clinical assessment. Immediately after the DC-shock delivery (bold arrow), it was thought that she gone into VF, but with careful inspection, the R labelled in numbers can be seen. The patient clearly reverted to sinus rhythm. These artifact waves could be re-induced by just light touching of one of the chest electrodes (bottom strip).

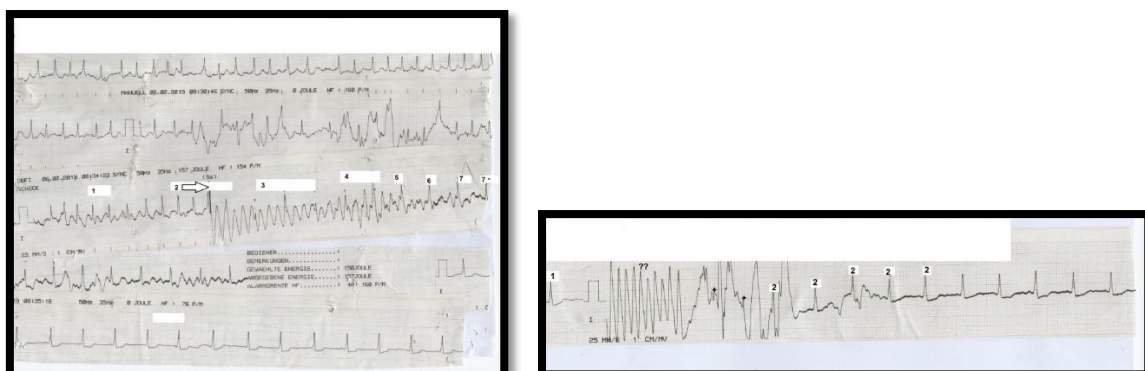


Figure 4: Single lead ECG where artifacts were misinterpreted as A fib

Figure 5 shows the Holter trace of 65 y old male with A fib. The long pause of 3.6 seconds was not associated with a dizzy spell or syncope and a bizarre wave at the middle of the pause (thick arrow) was seen. The pause starts one beat earlier in V6 (arrow), which points to an artifact due to electrodes dislodgement. The patient was advised for permanent pacemaker implantation but this was denied based on the findings.



Figure 5: A Holter trace where an artifact was misinterpreted as A fib due to electrode dislodgement

Discussion

The ECG artifacts can simulate many arrhythmias including VF, VT, SVT, A fib, A fl and rarely bradyarrhythmia. The careful inspection of the ECG or Holter traces and looking for the R wave at certain leads within the artifact waves quite carefully can minimize the confusion of these artifacts with arrhythmias. Correlating the clinical status of the patient and the symptoms during the time of occurrence of the artifact waves can distinguish them and avoids serious therapeutic mismanagements. It was traditionally stated by the father of arrhythmiology Mark Josephson that “The Physician should remember to treat the patient and not the ECG”. More experience with inspecting these artifacts can help to recognize them. Previous case reports indicate that similar artifacts have been mistaken for similar arrhythmias on different clinical situations like Parkinson disease 9, fractured arm 11, muscle twitches 8, and others 10,12,13,14. We could confirm the diagnosis of artifact in all the 13 patients and prevent serious mismanagements with drugs, DC shock or permanent pacemaker implantation.

Conclusion

Identifying the artifact in ECG and differentiating them from arrhythmias is highly important to avoid unnecessary and even dangerous interventions.

Disclosure

The author has no disclosures or conflicts of interest to report.

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قراءة التشتت الموجي في تخطيط القلب بصفة لانظميات ضربات القلب استعراض لمجموعة من الحالات السريرية

د. عمار طالب الحمدي

الخلاصة:

الخلفية: إن تشتت الموجات في تخطيط القلب وتسجيل الهولتر ظاهرة ليست نادرة اثناء الممارسة السريرية ومن الممكن أن يتم الإشتباه بتمييزها بصفة لانظميات ضربات القلب.

الهدف: توعية الأطباء الممارسين لتمييز ظاهرة هذا التشتت الموجي عن لانظميات القلب الفعلية.
المرضى وطريقة البحث: أدرج في هذه الدراسة ثلاثة عشر مريضاً جمعوا من العيادة الخاصة للمؤلف في محافظة السليمانية في شمال العراق للفترة من حزيران 2015 إلى آب 2020. المرضى الذين تم تشخيصهم خطأً بإجراء تخطيط القلب أو تسجيل الهولتر بصفة لانظميات القلب، ثم تم تمييز هذه الحالات بأنها تشتتات في موجات في تخطيط القلب. تم التمييز بين تشتت الموجات و لانظميات القلب من خلال التمعن الدقيق في تخطيط القلب والتعرف على موجة (R) من ضمن تشتت الموجات وربط التشتت الموجي مع أعراض المريض.

النتائج: تم الإشتباه في فهم التشتت الموجي على أنه فرقة البطين في حالة مريضين، وعلى أنه تسارع البطين في حالة أربع مرضى، وعلى أنه فرقة الأذنين في حالة مريضين، وعلى أنه ارتجاج الأذنين في حالة أربعة مرضى، وفي حالة مريض واحد تم الإشتباه به على أنه إحصار قلبي من الدرجة العالية.

الاستنتاج: إن تمييز التشتت الموجي عن لانظميات القلب أمرٌ ذو أهمية قصوى لتجنب الوقوع في الخطأ أثناء المعالجة.
الكلمات المفتاحية: التشتت الموجي، تخطيط القلب، اللانظميات.