44444 - TRANSCUTANEOUS NERVE STIMULATION (TENS) INDUCED ARTIFACTS ON THE ELECTROCARDIOGRAPH (ECG)

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INTRODUCTION. TENS, based on the gate control theory of pain, is frequently used for acute, chronic and cancer pain. Aim of this study was to review the literature of TENS induced ECG artifacts.

METHODS.

A literature search in all languages was performed of the PubMed and Medline databases (1971-2006). Additionally, a manual search of reference listings from all articles retrieved was performed. Characteristics, consequences and other clinical implications of ECG artifacts due to TENS were noted.

RESULTS.

Seven cases of TENS induced artifacts were reported (table) (1-7). Artifacts occurred while electrodes were placed including at parasternal (1), epidural (2), thoracolumbar (3) or thoracic (7) sites. In five reports (1-3,6,7) artifacts resembled Pseudopacemaker (PPM) spikes. On two occasions (3,7) it was misinterpreted as pacemaker malfunction. In one case (4) artifact simulated AF, and in another (5) TENS induced electrical activity was recorded as VF by ICD. In the later report (5) it resulted in delivery of DC shocks on 4 separate occasions. Artifacts disappeared on deactivation the TENS machine, which was once done with magnet (2). In a critically ill patient PPM malfunction and pacemaker lead perforation was suspected till X-ray chest revealed TENS leads (7).

DISCUSSION.

Electrical activity produced by TENS can be recorded by cutaneous or cardiac electrodes. Depending on the mode (cutaneous -40-150 Hz or pulsed / acupuncture-like bursts -100Hz at 1-2 Hz) used, high or low frequency artifacts can occur. Artifacts may be due to detection and amplification of the signal by ECG electrodes, and saturation of the input amplifier by the TENS output or triggering the pacemaker detection system. If arrhythmias develop in a patient who is using TENS, artifact should be included in the differential diagnosis.

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Table: ECG artifacts due to TENS

R ef	Age / Sex	Pre artifact rhythm	Characteristic of the artifact and mimicked arrhythmia	Consequences	Correction and Diagnosis confirmation
1	—	—	multiple PPM spikes. Non-interpretable ECG	—	various measures suggested.
2	63 /M	NSR	Multiple high frequency PPM spikes	cardiology consultation done	deactivation by use of a magnet
3	80 /F	—	Low frequency PPM spikes	pacemaker malfunction reported	deactivation of TENS unit
4	39 / F	atrial flutter (AF)	AF. Normal sinus P waves can be seen.	—	—
5	80 /F	ICD	VF (on intracardiac cardiogram)	shocks from ICD	TENS unit disabled
6	22 / F	sinus tachycardia	PPM spikes. Non-interpretable ECG	Frequent ECGs performed	TENS machine off
7	75 /F	sinus tachycardia	Regular PPM spikes.	pacemaker malfunction suspected.	X-ray chest revealed TENS machine