A Novel EEG Artifact in the ICU: Ultrasound Transducer simulating Ictal Activity

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Doctora
MARTHA NEGRETE MARTINEZ
Directora de posgrados
Escuela de Medicina y Ciencias de la Salud
Universidad del Rosario

Apreciada Martha,

Por medio de la presente deseo reportar que el doctor **JORGE LUIS RAMIREZ MOLINA**, residente del programa de especialización en **Neurofisiología** de la Escuela de Medicina y Ciencias de la Salud, ha adelantado **el producto final,** del trabajo denominado **"A Novel EEG Artifact in the ICU: Ultrasound Transducer simulating Ictal Activity"**, el cual fue revisado y avalado por el tutor **Luis Carlos Mayor**, y se encuentra registrado en la Unidad de Apoyo a la Investigación Formativa de la Vicedecanatura de Investigación y Consultaría de la Escuela de Medicina y Ciencias de la Salud.

Cordialmente,

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Amparo Susana Mogollón Pérez
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Abstract

We describe an EEG artifact seen during an ultrasound-guided central venous catheter placement that showed an evolving ictal-like electrographic pattern.

Keywords: Artifact, Electroencephalography, Ultrasound Transducer, Static Electricity.

Introduction

Intensive care units (ICU) are electrical hostile environments for EEG recordings. Patients are often put through diagnostic and therapeutic procedures that require the use of ultrasound devices. The early identification of potential electrical artifacts in these situations, may avoid misdiagnosis and errors in the interpretation of EEG recordings and also will prevent unnecessary interventions.

We describe a case of a non-physiological electrical EEG artifact occurring during ultrasound-guided central venous catheter placement.

Materials and Methods

A 90 year-old male was admitted to the ICU with fever, new-onset seizures and progressive functional deterioration. He was supported with artificial respiration, vasopressors, anticonvulsants, antibiotics, sedation and analgesia. A video-EEG (*VIASYS Nicolet NicVue 2.9, Middelton, Wis.*) was ordered to rule out possible non-convulsive seizures. The study showed a right temporal rhythmic delta activity, intermixed with occasional anterior temporal spikes (FIGURE 1). But surprisingly, in addition, the EEG demonstrated an evolving bi-frontal low-amplitude fast activity, maximum over the left frontal-polar region.

This activity had an increasing amplitude, subsequent decreasing frequency, with more diffuse slow activity ending with a spike-slow wave appearance maximum over the right frontal-central electrodes (FIGURE 2-8). It had a duration of 2 minutes approximately. We then observed that this activity while an ultrasound device for a venous central catheter placement was on. When this device was turned off, that activity ended abruptly. The activity was similar to an ictal electrographic pattern.

Results and Discussion

Upon review of the literature, no similar report was found [1–4]. Electronic devices like ultrasound cause alternating current fields that generate static charges. These can emit a varied range of frequencies [1,5].

For the placement of central venous catheters, ultrasound-guided devices can be used. These transducers use 8-10 Hz frequencies for the detection of vascular structures [5,6].

In the ICU setting, use of video adds value to the EEG recordings [7,8]. Chest percussion, physiotherapy [9], insertion of IV devices, echocardiograms and ultrasound-guide central venous catheterization can generate artifact that may misinterpreted as ictal or interictal epileptiform activity.

Disclosure of Conflict of Interest and Funding Sources

J.L. Ramírez-Molina and L.C. Mayor have no conflicts of interest in relation to this article and have not received any kind of funding.

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FIGURES

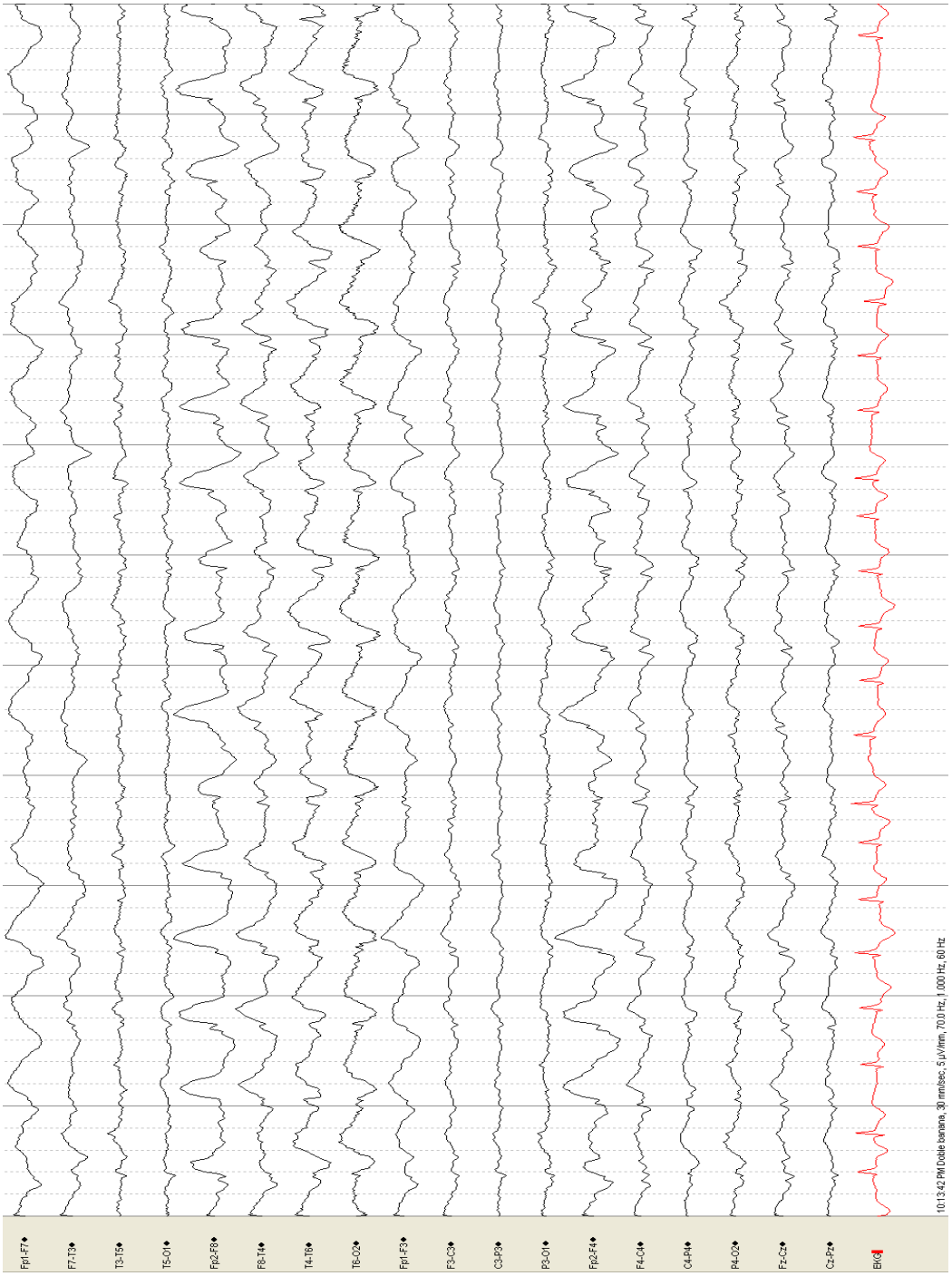

FIGURE 1. Inter-ictal Activity. Right temporal continuous rhythmic delta activity with occasional anterior temporal spike discharges. (Double banana montage, High pass filter = 1.0 Hz, Low pass filter = 70 Hz, Notch filter = 60 Hz, speed page = 30 mm/sec)

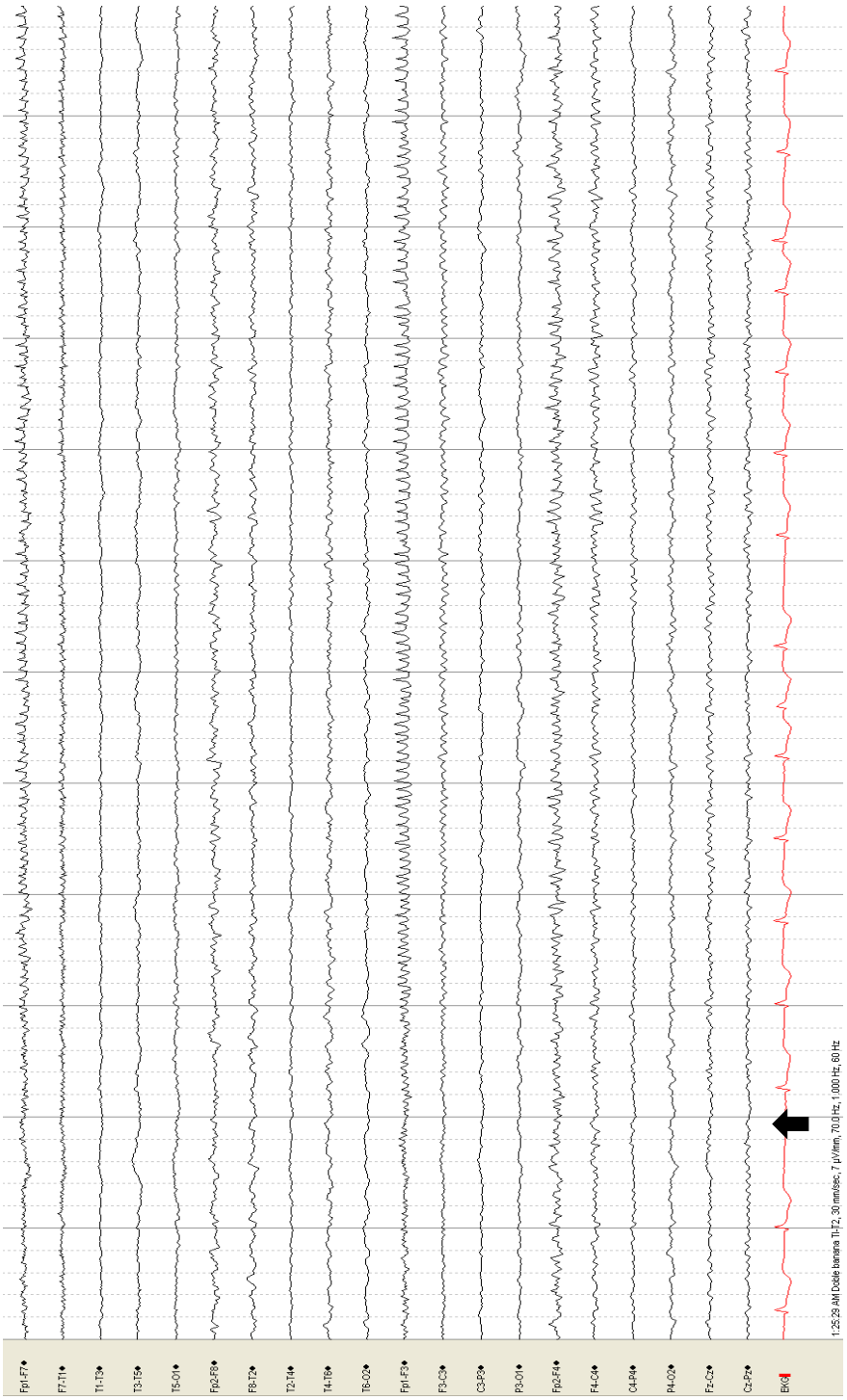

FIGURE 2 – shows the pattern start. The arrow points the collocation of the transducer. (Double banana montage, High pass filter = 1.0 Hz, Low pass filter = 70 Hz, Notch filter = 60 Hz, speed page = 30 mm/sec)

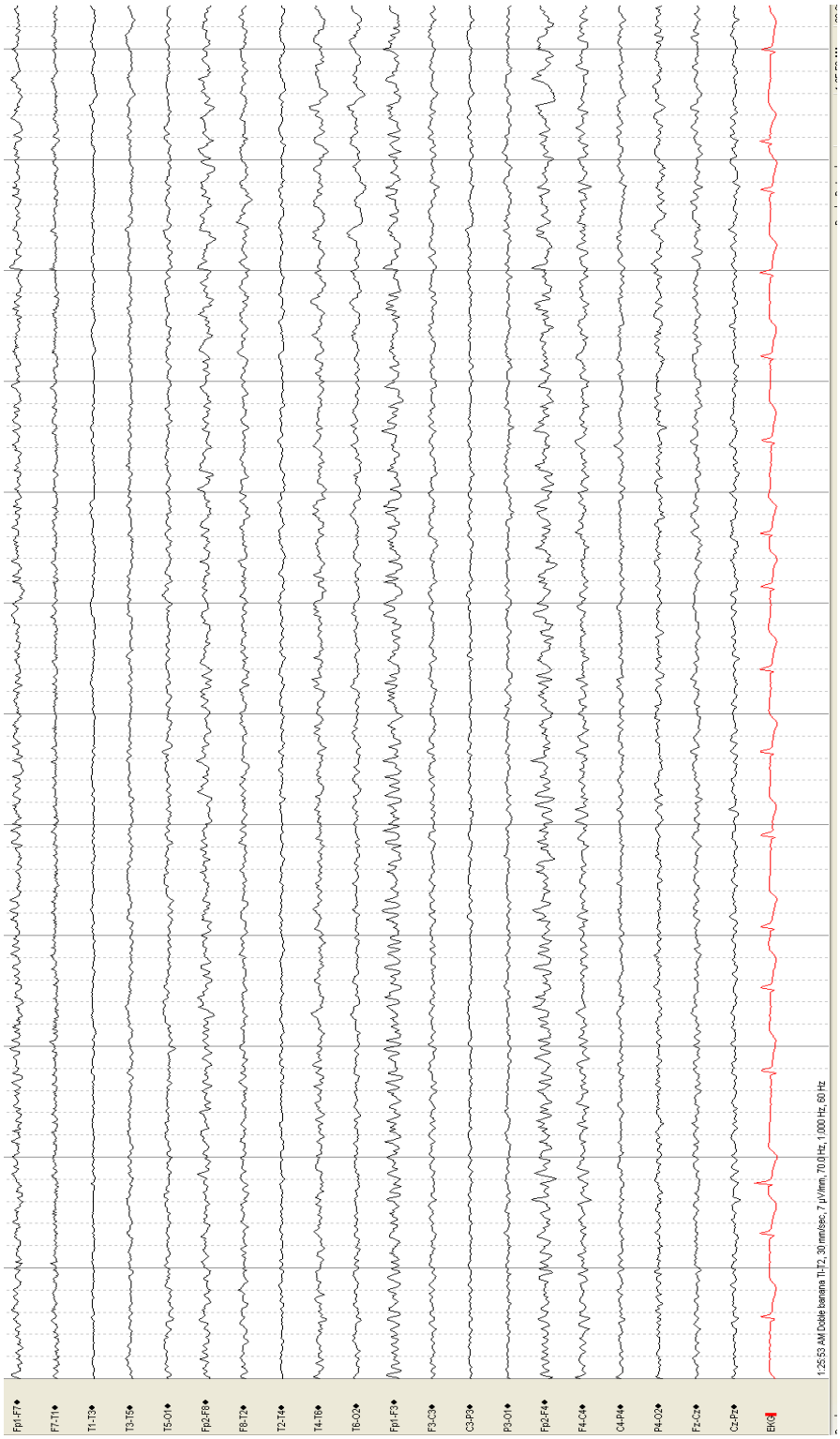

FIGURE 3 - show the initial progression of the pattern. (Double banana montage, High pass filter = 1.0 Hz, Low pass filter = 70 Hz, Notch filter = 60 Hz, speed page = 30 mm/sec)

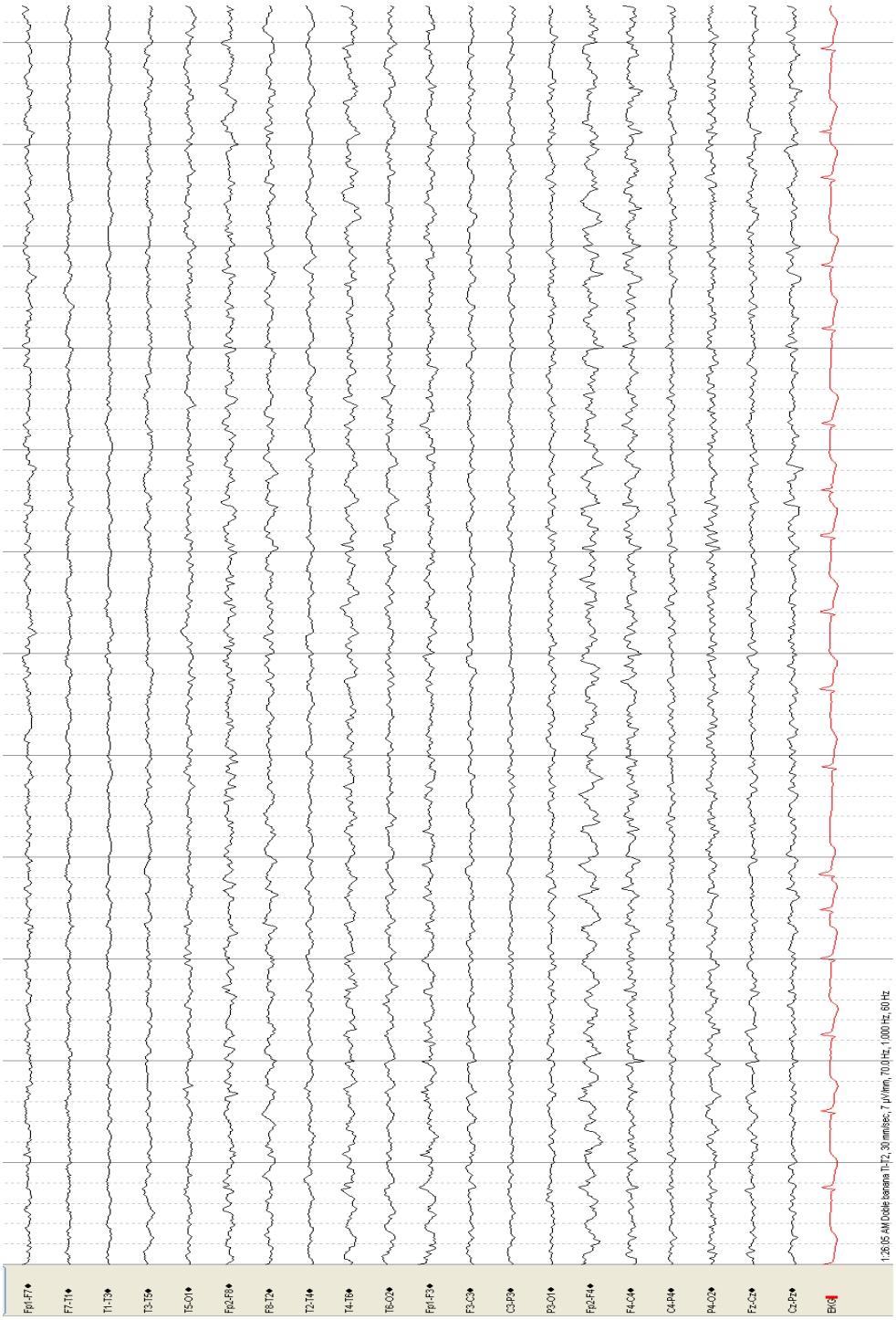

FIGURE 4 - show the initial progression of the pattern. (Double banana montage, High pass filter = 1.0 Hz, Low pass filter = 70 Hz, Notch filter = 60 Hz, speed page = 30 mm/sec)

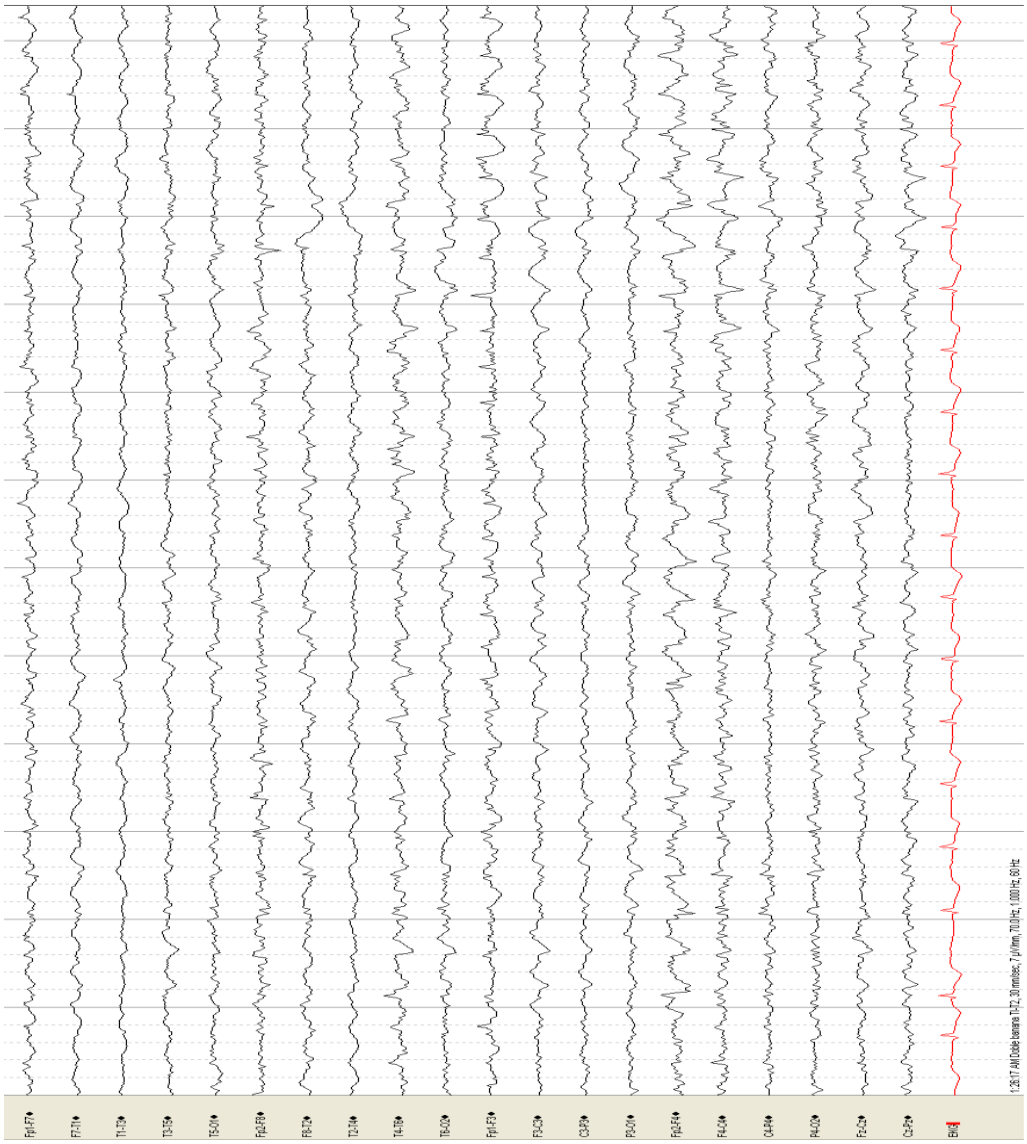

FIGURE 5 - show the initial progression of the pattern. (Double banana montage, High pass filter = 1.0 Hz, Low pass filter = 70 Hz, Notch filter = 60 Hz, speed page = 30 mm/sec)

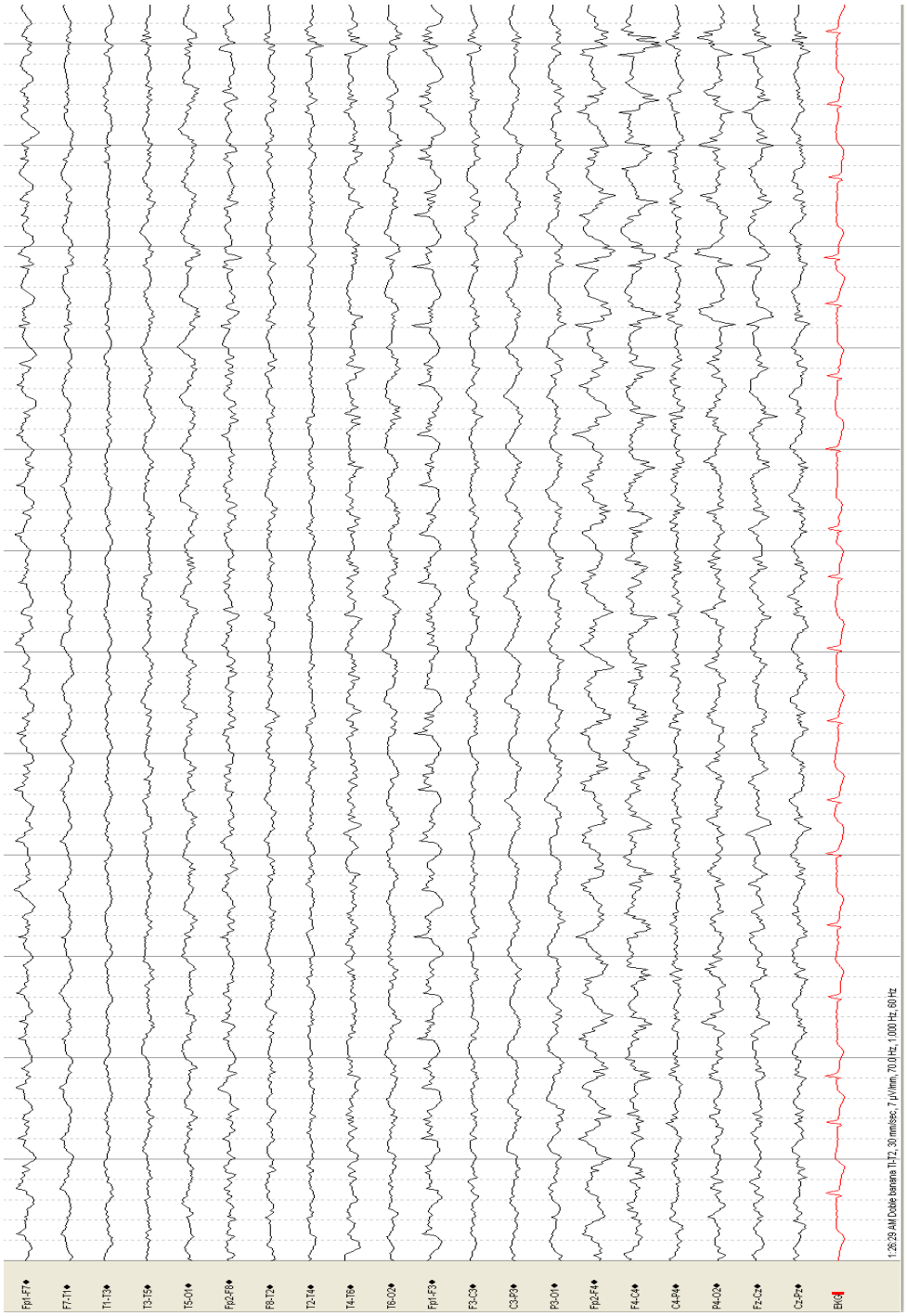

FIGURE 6 - show the further progression of the pattern. (Double banana montage, High pass filter = 1.0 Hz, Low pass filter = 70 Hz, Notch filter = 60 Hz, speed page = 30 mm/sec)

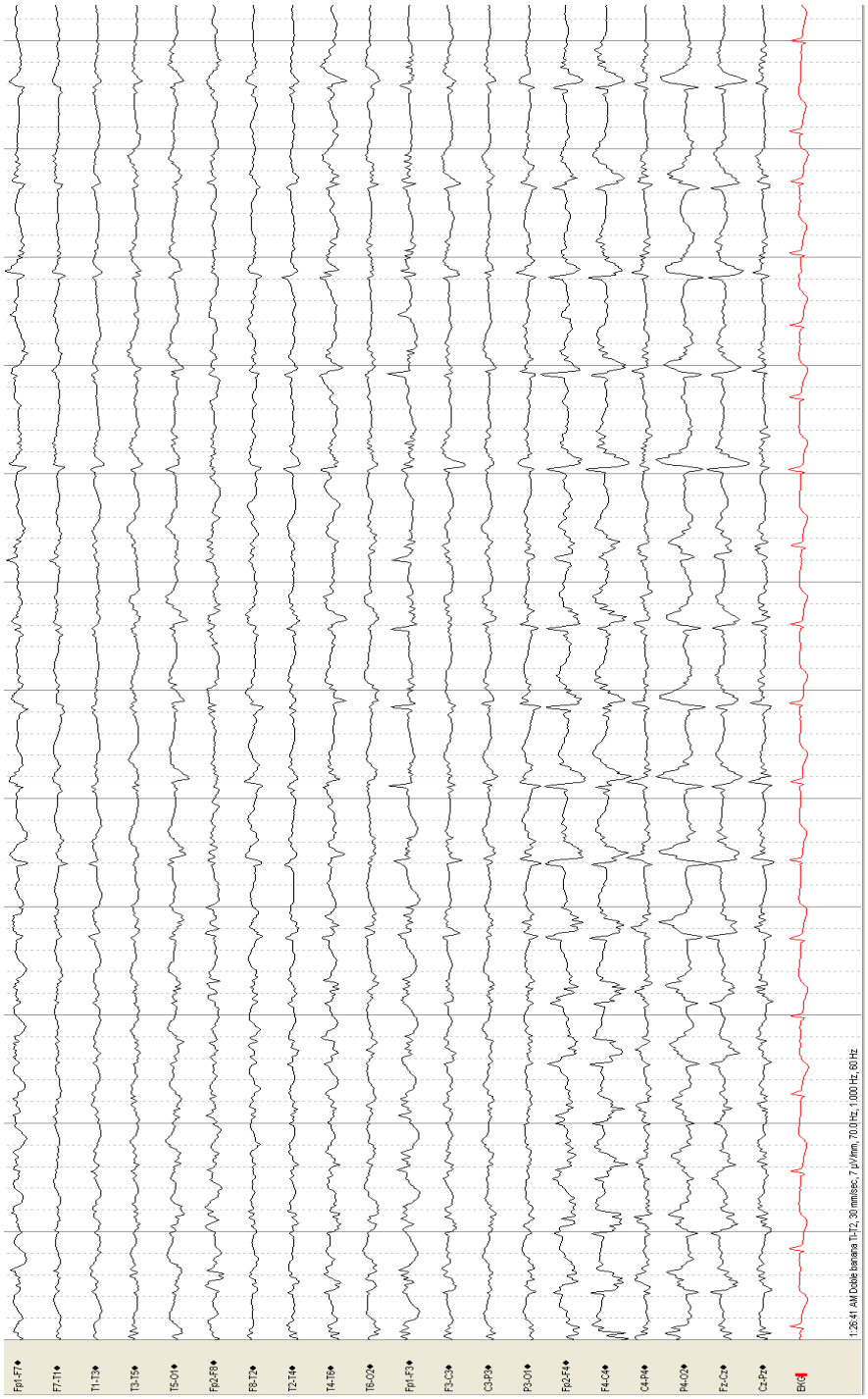

FIGURE 7 - show the further progression of the pattern. (Double banana montage, High pass filter = 1.0 Hz, Low pass filter = 70 Hz, Notch filter = 60 Hz, speed page = 30 mm/sec)

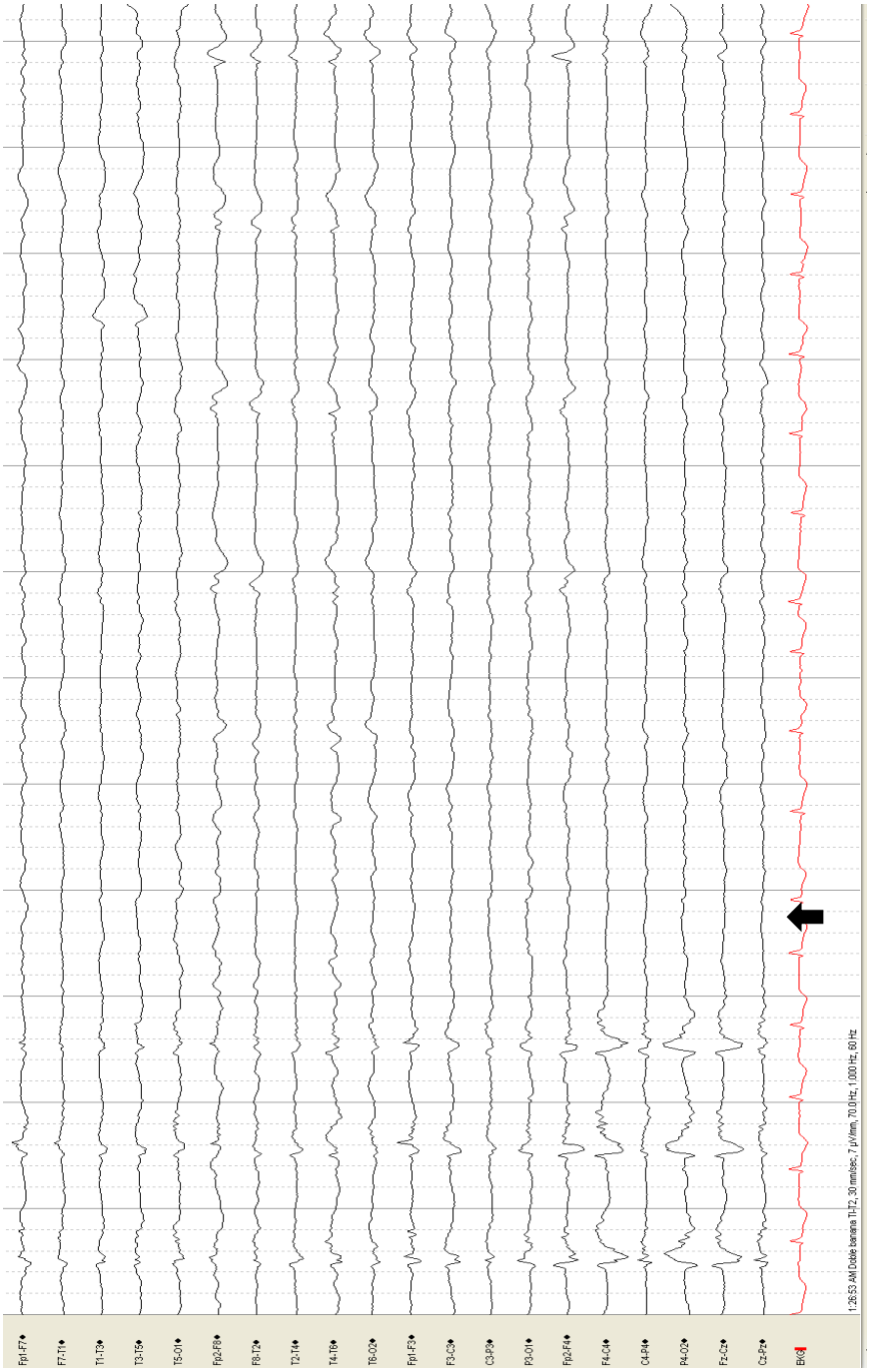

FIGURE 8 - Shows the abrupt end of the activity and the arrow points the withdrawal of the transducer. (Double banana montage, High pass filter = 1.0 Hz, Low pass filter = 70 Hz, Notch filter = 60 Hz, speed page = 30 mm/sec)