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Correspondence

Amyotrophic lateral sclerosis (Lou Gehrig's disease) is caused by electric currents applied to or induced in the body: It is an iatrogenic disease of athletes caused by use of electrotherapy devices

Amyotrophic lateral sclerosis (ALS), also known as Lou Gehrig's disease after the famous New York Yankee baseball player, is a rare condition, characterized by deterioration of both upper and lower motor neurons. It has an incidence of about 2.4 per 100,000 population per year with peak onset between 55 and 75 years of age and an average survivorship of 3 years after onset [1]. Over 90% of ALS cases are sporadic, with familial cases making up the balance. An ALS variant which is clinically different from sporadic ALS is present in the Western Pacific and is associated with symptoms and pathological characteristics of both Parkinson's disease and Alzheimer's disease.

Since the reports of an increased incidence of ALS in Italian soccer players [2], and US professional football players [3], I had been suspicious about their exposure to TENS devices and electrical diathermy devices, because of the repeated reports [4–8] of the connection of ALS with electrical shocks and electrical environments. Three of 55 members of the 1964 San Francisco Forty-niners US professional football club died of ALS [9]. The expected cases of ALS in 55 people followed for 30 years is $55 \times 30 \times 2.4 / 100,000 = 0.04$, so the relative risk of ALS in this cluster was 3.0/0.04 or 75 times expected.

In August 2007 the Seattle, Washington USA media carried information about Melissa Jo Ericson, a young woman who at age 28, had been recently diagnosed with amyotrophic lateral sclerosis. She had been a basketball player at the University of Washington, followed by a professional basketball career in Europe. She was much younger than expected for this diagnosis. In Washington State 0.5% of ALS deaths occur in individuals under age 30. I contacted her and inquired about her use of trans-cutaneous electric stimulation devices (TENS) for pain management. She reported that she and her high school, college, and professional teammates had made extensive use of TENS with devices provided by the schools and the professional teams [10].

Trans-cutaneous electrical nerve stimulation, commonly referred to as TENS, is application of electrical current through the skin for pain control. The unit is usually connected to the skin using two or more electrodes. Most battery-operated TENS units are able to modulate frequency, intensity and pulse width of the applied current. Electrical diathermy devices use short wave radio frequency radiation and microwaves for deep tissue heating. All these devices generate electric currents in tissue. Short wave diathermy units have been used in the US since around 1930 and TENS units since 1974 [11].

There is some circumstantial evidence that Lou Gehrig, the famous New York Yankee baseball player who died of ALS and whose name is synonymous with the disease might have been treated

with diathermy. In 1933, Boston Red Sox player Dale Alexander had his baseball career cut short by a serious leg burn and gangrene following a diathermy treatment by Red Sox trainer Doc Woods, so diathermy was in use by major league baseball teams in the early 1930s [12]. A long-term New York Yankee trainer, Earle V. "Doc" Painter, burned Joe Di Maggio's foot during a diathermy treatment during spring training 1936, DiMaggio's first year with the Yankees [13]. Babe Ruth, Lou Gehrig and Joe DiMaggio were all reported to be patients of "Doc" Painter [14]. Lou Gehrig suffered an attack of "lumbago" on July 13, 1934 which required him to be helped from the field by his teammates. It is quite possible that he received diathermy treatments for the "cold in his back" or other musculoskeletal problems. His baseball performance declined in mid-1938, he had ALS symptoms in 1939 and died in 1941 [15].

Bob Waters, one of the three members of the 1964 San Francisco Forty-niners professional football team who died of ALS, reported being treated for many hours with diathermy in the team's training room [16]. A least a dozen US and Canadian professional football players have or have died of ALS [3].

I hypothesize that sporadic ALS is caused by exogenous electrical currents induced in or applied to the body. Since most cases of ALS have no obvious connection to electrical shock or electrical therapy, most non-familial cases must have had currents induced in their bodies by working or living in environments with strong EMFs. In addition to TENS and diathermy exposure, electro-convulsive shock therapy (ECT), and electro-surgery also generate electric currents in patients.

Electro-convulsive shock therapy causes clinic convulsions by passing electricity through the brain between electrodes placed on the temples or fore and aft on the same side of the head. Typically, the electrical stimulus used in ECT is about 800 mA has up to several hundred watts, and the current flows for between 1 and 6 s. Usually 12 treatments are given, 2–3 per week [17].

Electro-surgery is the application of a high-frequency electric current to biological tissue during surgery. Instead of a scalpel, an electrode known as an RF (radio frequency) knife is used. Various wave forms, duty cycles and modulations are used for cutting, burning, coagulation, desiccation, etc. Open circuit voltage in electrosurgical waveforms is typically in the range of 300–10,000 V peak-to-peak [18]. It would be interesting to examine the incidence of ALS in operating room personnel and in patients who have had electro-surgery.

This hypothesis could be tested by questioning ALS cases and a suitable comparison group like patients with multiple sclerosis about their electrical exposures. Questions should include: history of lightning strike, electric shock, TENS use, shortwave or microwave diathermy treatment, electro-convulsive shock therapy, electro-surgery, and residential, occupational or hobby exposure to EMFs, including use of electrical devices like cell phones, laptop computers, electric power tools, and electric hair dryers. All new

patients with ALS should have their residential and work environments measured for EMFs, including as much of the non-ionizing electromagnetic spectrum as possible. The higher frequencies are more likely to induce currents in the body, since the induced currents are proportional to frequency. The residential and work environments of ALS cases should have higher levels of EMFs than the comparison cases.

If this hypothesis is correct, iatrogenic cases of ALS could be prevented.

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