Lightning Data Center
Minutes
May 14, 2004
St. Anthony Hospital
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Quote of the Month:

"I landed in London on a wintry autumn evening. It was dark and raining, and I saw more fog and mud in a minute than I had seen in a year."

Charles Dickens, 1850 in *David Copperfield*

1. Meeting began at 11:30 am and adjourned at 1:15 pm.

2. Members present: Bradley, M Cherington, N Cherington, Clark, Cohen, Gift, Foley, McDonough, Middleton, Moore, Olson, Russon, Schoessow, Stewart, Wachtel, Yarnell.

3. I brought the following articles (abstracted in part here):

   a. Furrer M, et al. Hazards of an alternative medical device in a patient with a pacemaker. N Eng J Med 2004;350:1688-90.

      "Pacemakers and defibrillators are frequently exposed to a 'hostile' electromagnetic environment from a variety of external sources. These include magnetic resonance imaging (MRI) equipment, metal detectors, antitheft devices, household appliances, some digital cellular phones, and power tools. The most frequent adverse responses to electromagnetic interference are inappropriate temporary inhibition, as documented in our patient, or triggering of pacemaker stimuli and reversion to asynchronous pacing. A 52-year old man with a dual-chamber pacemaker presented with dizziness and near-fainting. The symptoms occurred exclusively during self-prescribed therapy with a Zapper device a battery-powered pulse generator. The Zapper is an alternative medicine treatment."

   b. Shaw CI, et al. Cellular phone interference with the operation of mechanical ventilators. Crit Care Med 2004;32:928-31.

      "Both staff and visitors entering the ICU often carry cellular phones, wireless personal digital assistants, two-way pagers, or walkie-talkies. These wireless devices permit easy communication and exchange of data but might also emit sufficient radio frequency energy to interfere with the function of mechanical ventilators. Most of the situations tested in this study did not produce an malfunction, suggesting that RF transmissions from cellular phones are generally well tolerated by the mechanical ventilators. Current cellular telephones operate in digital modes with varying transmit powers under the control of a nearby cellular tower. During 'standby' operation the cellular telephone periodically transmits a low power to identify itself to the cellular tower. When the cellular telephone rings, it transmits a constant signal at full

power until answered. We hypothesized that the period of greatest interference potential with the current generation of digital phones was during the 'ringing' period."

c. Krieger K. Lightning strikes and gammas follow? Science 2004;304:43.

"Gamma rays shoot out of the sky minutes to hours after lightning strikes. Greenfield and colleagues suspect that the lightning's electric field sends positive particles, perhaps ionized hydrogen atoms, careening into other atoms. The researchers suggest that accelerated protons slam into argon-40..and transform it into chlorine-39. The chlorine then decays immediately giving off a gamma ray as it relaxes. Chlrine-39 has a 56 minute half-life which fits nicely with observed gamma rays. But Greenfield says the gamma rays could also come from many different reactions."

4. Rich Kithil, kindly, provided us with posters on lightning safety prepared by NOAA. The posters were distributed to members to be displayed at places they believe to be appropriate.

5. Larry Moore mentioned that he visited his nephew's high school soccer game in Chicago. The coach followed the 30/30 rule and did not allow the game to resume for 30 minutes following the last lightning flash. Vicki Middleton and Greg Stewart will approach the Denver Metro School systems to suggest they follow the Lightning Safety Group recommendations.

6. I read an email sent to us by a grandfather whose granddaughter was tragically killed by lightning in August 2003 in the Rocky Mountains at an elevation of 10,000 feet. During the storm, the grandparents and granddaughter were in an area of small trees looking at a meadow when the fatal lightning struck. The time was 3:30 pm. The grandparents started and continued CPR for over an hour. He agreed to provide us with additional information.

   The LDC members had questions about this catastrophic event (regarding coroner's report, state of burns, etc.) They suggested I ask the grandfather to provide more information to Sheryl Olson. Sheryl will then report back to us.

7. Today's presentations were on the subject of Lichtenberg Figures. Our speakers were Sheryl Olson, Flight Nurse with Penrose-St. Francis Health Care System and Rick Russon, President of Red Ocher Solutions and a graduate in Physical Oceanography from Florida Institute of Technology. Sheryl has attended to many traumatic accidents including lightning injuries in her capacity as a Flight Nurse.

   The presentations were superb and the discussions were energetic and educational. I cannot do justice in these minutes to the presentations, but here is the information from my notepad:

   What is known about Lichtenberg Figures?
   1. They are found in only one medical condition – lightning injuries.
   2. They are transient (last for a matter of hours). Although Sheryl may have seen a patient with a permanent ferning pattern.

3. There is no pathology found on biopsy.
4. The ferning pattern does blanche to pressure (reported by Phil Yarnell).
5. The “lesion” is flat, not raised.

Sheryl presented two patients who had LF.

1. A pig farmer with LFs on upper and lower limbs and trunk. LF usually appears at some time after the lightning strike.
2. A woman had LF’s on her neck below a necklace and on her thorax. LF appeared 2.5 hours after the lightning strike and disappeared by 24 hours. LFs appeared after EKG pads were placed. Mike Foley asked what was the stimulus to account for these EKG pad ferning patterns? Howard Wachtel and Gil McDonough speculated that the answer may be the heart. This patient had keraunoparalysis of the lower limbs for about 15 minutes (weakness of muscles, absent pulses). Larry Moore wondered if the human body, acting like a capacitor, could account for the delayed appearance of LF.

Rick Russon stated at the beginning of his presentation that he noticed that at every Lightning Data Center meeting – for every question answered, 5 more were asked and left unanswered. Rick asked the question: What is the stimulus for LF? He speculated: accumulation of free electrons above, on and within the skin.

1. Why LF is seen only with lightning? Lightning has the energy to accelerate electrons at relativistic speed into the skin. Free Space Charge.
2. LF is formed in acrylic block when “irradiated” by a high-speed beam of electrons. Linear accelerator.
3. Dielectric breaks down. Molecules are ripped apart; electrically conductive regions are formed. Not in anatomic patterns of nerves or vessels.
4. Theory – electrons from lightning irradiate the skin causing a space charge within the epidermis. Dielectric breakdown – LF pattern.
5. Gil McDonough commented that epidermis charge is positive; dermis is negatively charged.
6. Fern or arborization pattern associated with positive charges; flower pattern with negative charges.
7. X-rays and gamma rays penetrate deeper into the skin resulting in subcutaneous effects.
8. Howard Wachtel wondered about: high field gradient across skin layer may contribute to LF.

8. These minutes do not represent official positions of LDC or its members. They simply reflect comments made during the meeting.

9. Next meeting: Friday, June 11, 2004 at 11:30 am in the Main Auditorium of St. Anthony Central Hospital.

Speaker: Gilbert Mc Donough, MD
Topic: Lichtenberg Figures, Part 2

Respectfully submitted,

Michael Cherington, MD