Influence of Static Magnetic Field on Blood Coagulation in Patients Treated with Hemodialysis

Dziewanowski Krzysztof1, *, Drozd Radosław1, Krzystolik Elżbieta1, Krzystolik Andrzej2, Machaliński Bogusław3, Mazurkiewicz Stanisław4

1Centre of Nephrology and Renal Transplantation, Regional Hospital in Szczecin, Poland
2Department of Cardiology, Regional Hospital in Szczecin, Poland
3Department of General Pathology, Chair of Physiopathology of Pomeranian Medical University, Szczecin, Poland
4Faculty of Mechanical Engineering, Cracow University of Technology, Cracow, Poland

Email address
krzysztof.dziewanowski@gmail.com (D. Krzysztof)

Citation

Abstract
The aim of our study was to evaluate the impact of static magnetic field (set of Multimag magnets) on the process of blood clotting time measured with APTT (partial thromboplastin time) in patients treated with hemodialysis. Approximately 350-400 ml of blood was drawn from patients with renal transplant and erythrocytosis. Small amount of heparin was added to this blood. Then the resulting volume was divided into two equal parts. Two identical dialyzers and blood lines were filled with this blood. Identical flow of blood was forced through both sets, while one of those sets was equipped with Multimag magnet (0, 1 Tesla). Samples of blood were collected from both lines and a PTT was assessed in each of them. There was significant shortening of a PTT time (average about 30%) in sets without magnets as compared to the lines carrying Multimag. Tests carried out have shown that the magnetic field produced by the magnet system (Multimag) planted on a typical blood line used in hemodialyzed patients, significantly prolonged blood clotting time evaluated by a PTT and thus prolonged the ability to continue treatment as compared with sets without magnets.

1. Introduction
Magnetic energy is one of the most important factors influencing life on Earth. Most of biological processes in the human body are dependent on electromagnetic forces generated by magnetic field. In the available literature there are few reports about the influence of magnetic field on the process of blood coagulation in humans.

2. Materials and Methods
The aim of our study was to evaluate influence of static magnetic field of 0.1 Tesla magnitude produced by a set of Multimag magnets (U.S. Patent 6, 143, 0450) on blood clotting in the device used for hemodialysis used in patients with renal failure.

In 10 patients with kidney transplants and erythrocytosis, at the time of regular follow-up outpatient visits, after controlling complete blood counts and establishing clinical indication for phlebotomy, 350-400 ml of blood was collected, to which 100 ml of 0.9%
NaCl and 0.5 mg of heparin were added. The resulting solution was divided into two equal parts, then two identical typical bloodlines with common polynephronic capillary dialyzers (Nipro -Elisio 170M with 1.7 square meter exchange area) were filled with the solution. Both sets were then connected to two identical dialyzers, forcing identical blood flow at the rate of 100ml/min with the use of pumps. One blood line was permanently equipped (before dialyzer) with Multimag magnet (0.1 Tesla). Blood samples were collected from both lines simultaneously every 2-3 hours and aPTT (sek) was measured. (Fig. 1, 2).

Figure 1. Multimag blood line.

Figure 2. Test and control.
3. Results

At the beginning of our measurements we have found that after over a dozen of hours coagulation of blood took place in the line of the kidney dialyzer without the magnet, while in the line with Multimag magnet this did not occur or it happened with a considerable delay. Further observations demonstrated a significant decrease in APTT time (on the average about 30%) in lines without the magnets in comparison to lines with Multimags, and there was a significant correlation between the two sets of results (0.973) Fig. 3.

![Figure 3. Comparison of aPTT with and without magnetization.](image)

**Table 1.** Without Mg (time aPTT – sek).

<table>
<thead>
<tr>
<th>Time (h)</th>
<th>Average</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>140</td>
<td>136</td>
</tr>
<tr>
<td>10</td>
<td>114</td>
<td>110</td>
</tr>
<tr>
<td>15</td>
<td>104</td>
<td>100</td>
</tr>
<tr>
<td>20</td>
<td>90</td>
<td>88</td>
</tr>
</tbody>
</table>

**Table 2.** With Mg (time aPTT - sek).

<table>
<thead>
<tr>
<th>Time (h)</th>
<th>Average</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>113</td>
<td>110</td>
</tr>
<tr>
<td>10</td>
<td>86</td>
<td>88</td>
</tr>
<tr>
<td>15</td>
<td>74</td>
<td>75</td>
</tr>
<tr>
<td>20</td>
<td>47</td>
<td>48</td>
</tr>
</tbody>
</table>

With Mg/Out Mg p = 0.003

There was a significant shortening of APTT time (average about 30%) in sets without magnets as compared to the lines carrying Multimag. Tests carried out have shown that the magnetic field produced by the magnet system (Multimag) planted on a typical blood line used in hemodialyzed patients, significantly prolonged blood clotting time evaluated by APTT and thus prolonged the ability to continue treatment as compared with sets without magnets.

4. Discussion

“Magnetic energy is the elementary energy which determines life on Earth," these words of Nobel prize winner Werner Hesenberg help us to realize the importance of this issue. Proper human magnetic field (biofield) is produced by biochemical processes occurring in our body and by the action of Earth's magnetic field whose magnitude is estimated at 0.1-1.0 milliTesla (1-10 Gauss). Absence or diminishing of this natural magnetic field exerts a number of adverse effects on the human body. This is confirmed by examinations of astronauts - orbital station workers, who stay a long time outside the natural magnetic field of the Earth. Attempts to fix this issue are done by equipping their spacesuits with magnets. It is widely believed that the north pole of the Earth (negative) is more beneficial for human organisms than the south pole (positive). In the last two centuries, there was a significant weakening of Earth's magnetic field (possibly through influence of solar activity). According to some authors this explains increased predisposition to certain diseases.

Another factor disrupting our biofield is the "electromagnetic smog" produced by relay stations, radio and television waves, high voltage lines, computers, laptops, cell phones, etc. (6.9). Clinical signs of disruption of our biofield are numerous and often unspecific: headache, increased fatigue, impaired concentration (Alzheimer's disease?),
drowsiness or sleep disorders, neuroses, impaired libido, decreased immunity (infectious diseases), increased predisposition to cancer (leukemia in children), etc.

Beneficial effect of magnets was already appreciated by our ancestors. Magnets were considered as means of prolonging life in ancient Egypt. In China they were described as a stone of health, and in ancient Greece, they were called "stone of life". Paracelsus advocated wearing magnets due to their beneficial effects on the psyche and to aid in difficulty falling asleep. In the nineteenth century, James Clerk Maxwell demonstrated that any change in the electric field induces a change in the magnetic field and that any change in the magnetic field induces a change in the vortex electric field. He also established the first modern recommendations in magnetic field therapy. Principles of operation of the fixed and alternating magnetic field are used widely today also outside medicine (e.g. fuel economy in automobile engines, linear flow of oil in pipelines - to reduce its viscosity, in initial acceleration of rockets, torpedoes, etc.).

Modern medical science has allowed to establish that physiological human biofield, among others, influences the correct polarity of cells of the body (action of the natrium-potassium pump producing a potential difference between cell membrane and cytoplasm at about 100mV), as well as physiological function of the cardiac conductive system, stimulation and inhibition in the central nervous system, intellectual processes, conduction of electrical impulses in the peripheral nervous system, etc.

Restoring or improving proper biofield is extensively used by present-day physical therapy particularly by its branches such as magnetic stimulation and magnetic therapy. Different devices (magnetic bracelets, magnetrons, Polish device "Viofor," etc.) are used for this purpose. [2, 3, 5, 11, 13].

Both static (predominantly in the East) and alternate (predominantly in the West) magnetic field are used. It is generally accepted (according to the WHO) that treatment with these devices with magnitude prescribed for medical purposes, is safe, and its effectiveness in the treatment of, for instance, chronic pain, reaches 80%. Beneficial effect of this therapy in wound healing, treatment of injuries, fractures, as well as in neurotic or depressive conditions is emphasized [9, 12].

In the available literature there are few reports about the influence of magnetic field on blood coagulation in patients [1, 7, 8, 10].

Czajka E., et al in their work examined the influence of low frequency magnetic field used in magnetic therapy on selected parameters of coagulation in animals demonstrating significant increase in prothrombin time in the studied group of rats [4]. Observations from the Institute of Technology in Osaka Prefecture (Japan) demonstrated that static magnetic field produced by Trion 2 magnetic bracelets used by a group of patients caused dilation of blood vessels, increased blood oxygenation, decreased adhesion and aggregation of platelets as well as reduced blood clotting.

In the available literature we did not find reports about effects of static magnetic field on blood clotting in dialyzed patients. Reported results seem to be interesting because using our preliminary observations and after future development of the above presented idea with adjustment of used magnetic field we can be theoretically expect:

- smaller average consumption of heparin during typical hemodialysis,
- a more efficient process of dialyzer reutilization,
- theoretical possibility (through anticoagulant action) to obtain a longer functioning time of dialysis catheters and fistulas,
- finally (which of course would require further research and clinical observations), beneficial effect of this method can be expected in inhibition of progression of atherosclerosis in patients, particularly with chronic renal failure treated with hemodialysis.

5. Conclusion

In summary, we conclude that use of the static magnetic field generated by the Multimag system used with typical blood lines in hemodialyzed patients significantly reduces blood coagulation evaluated with aPTT and thereby prolongs the ability to continue treatment as compared with a magnet-free set.

References


