

**ROLE OF MAGNESIUM SULFATE IN THE HEALING OF BLUNT TRAUMA RELATED
HEMATOMA****Jennifer Chu^{1*}, Frans Bruyninckx² and Steven Goodman³**¹MD, Emeritus Associate Professor PMR University of Pennsylvania USA.^{2,3}MD, Emeritus Clinical Professor, Physical Medicine & Rehabilitation, University of Leuven, Belgium.***Corresponding Author: Jennifer Chu**

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In the early morning of 2/19/24 a 76 old lady physician and first author of this manuscript, slipped and fell in the bedroom hitting the right inner lower leg against the edge of the bed. This was at 4:00 AM, still somewhat half asleep while trying to get to the bathroom.

Immediately, she noted a large swelling that developed in the inner medial aspect of the right tibia (fig.1). The swelling measured 10 x 8 x 3 cm.

While looking in her medicine cabinet for a heparinoid cream, she noticed the cannister of magnesium sulfate cream that she had used some 6 months earlier for shoulder pain. At 4:02AM she applied the body cream on the right leg where the vast hematoma had developed.



With a mobile phone camera she took a photograph of the hematoma at 4:03 AM and already then, 1 minute after applying the cream, she was able to see that the hematoma had already diminished considerably (Fig. 2).



And at 4:04 AM it had shrunk to about 5 x 4 x 2 cm, i.e. half the initial size. Since she felt no pain at all she self-tested by carrying out several simple exercises, and for the remainder of that day she continued with her routine activities including standing on the toes and heels, leg lifts, hip abduction and adduction exercises. She was also able to drive her car without problems.

There was a bruise on the skin and induration of the swelling. The indurated area was 10 x 5 cm. This area was not swollen.

She also photographed the bruise every day to document how long it would take before the bruise would resolve.

Although the bruise was considerably better by April 3rd, a light blue discoloration and an induration measuring 4 x 5 cm remained as residuals of the large hematoma that previously existed at the same area.

She also treated herself with Electrical Twitch Obtaining Intramuscular Stimulation (ETOIMS), a form of neuromuscular stimulation for improving microcirculation to the surrounding muscles and nerves.^[2]

Photographs listed:

1. The first photograph taken on February 19th 2024 at 4:03 AM immediately at time of injury showed massive swelling in the right lower leg. (labeled as 4:03 pic1)
2. Shrinking of swelling. This occurred in a matter of one minute at 4:04 AM to half the original size measuring 5x4x2 cm.

Table Showing Hematoma Onset of Swelling and Induration.

DATE	TIME	SWELLING SIZE (cm)	INDURATION SIZE (CM)	TIME OF ONSET OF INDURATION	SKIN COLOR
FEB 19 2024	4:03 AM	10x8x3 cm	NIL	NIL	NORMAL
FEB 19 2024	4:04 AM	5x4x 2 cm	NIL	NIL	NORMAL
APRIL 7 2024		NIL	10 x5 cm	FEB 21 TO APRIL 7	LIGHTBLUE

DISCUSSION

Overview/Pharmacology

- Magnesium is the fourth-most common cation in the body and second-most common intracellular cation after potassium.
- It is a physiological antagonist of calcium and has a fundamental role as a cofactor in over 300 enzymatic reactions and is available as an inorganic phosphate.
- In the cardiovascular system: Magnesium reduces the systemic vascular resistance in high doses. It prolongs sino-atrial (SA) node conduction time and reduces the rate of SA node impulse formation.
- Excess catecholamine induced vasoconstriction, arrhythmogenic effects and diastolic dysfunction are attenuated by magnesium.
- Antiepileptic properties and the action on central nervous system are not very defined. Various postulations includes cerebral blood-brain barrier protection, and anticonvulsant actions.
- Potentiation of nondepolarizing blockade is due to its presynaptic action
- Studies have shown it to be a physiological and pharmacological antagonist of N-methyl-D-aspartate (NMDA) receptors in the CNS.
- Kinetics: 30% protein bound, 50% is excreted by kidneys.^[1]

As a result of the very quick first minute positive reaction to the magnesium sulfate cream, there was no need for oral anti-inflammatory medications. Nor was there any indication for steroidal creams. The tibial bone and periosteum were probably unaffected by the blunt trauma since she felt no pain or discomfort in that region. Neither was there pain on local superficial and deep palpation, and during movements of the foot and ankle and the entire lower limb. Lower back and neck, shoulders and upper limbs were also pain free with normal range of motion.

She had no other medical conditions and there was no differential diagnosis with myxedema since the swelling occurred immediately after trauma and gradually resolved without requirement of any medications. Other medical treatments were also not needed.

Acute development of diabetic microangiopathy in the subcutaneous tissue was likewise not a differential diagnosis since the mass developed acutely after blunt trauma without needing any oral or injected medications. She also had no known history of diabetes.

The hematoma showed 2 time periods of heating: once immediately at resorption of the edema in the swelling,

and then with resorption of the induration gradually occurring over one month.

This case shows promising probable efficacy of skin application of magnesium sulfate and its ability to penetrate the skin to subcutaneous tissues and muscles resulting in its ability to resolve the hematoma.^[2,3]

Literature search did not show use of magnesium sulfate for relaxation of striated muscles. It can relax smooth muscle and is often used in anesthesia. Magnesium has a protective effect against epinephrine-induced cardiotoxicity because of its blocking action on calcium influx of ionized calcium and could be of therapeutic benefit in the perioperative period.

Magnesium sulfate is an electrolyte supplement that's typically given in the hospital as an injection. It can help raise blood magnesium levels if it gets too low.

Magnesium sulfate can also help prevent seizures that can occur in preeclampsia-eclampsia.

Literature is available on the surface use of magnesium sulfate where it was shown that skin absorption does occur and can be detected in the blood and in the urine.^[2] It has been suggested that it can be useful in athletes. There is evidence that magnesium sulfate can be absorbed through the skin. The magnesium sulfate cream that was used in this manuscript was of the same medical grade magnesium sulfate used in hospitals for IV-infusion in eclampsia and preeclampsia. Other ingredients in the cream consist of less than 1% of anti-inflammatory botanicals.

As a precautionary note it should be stated that magnesium sulphate cream should not be used on non-intact skin or in areas of eyes, genitalia and mucous membranes.

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