Effectiveness of the electrical muscle stimulation in prevention of venous thromboembolism and its impaction on the quality of rehabilitation of patients with fractures of the shin bones

V.N. Obolenskiy[1,2]

[1]City Hospital #13 (Moscow, Russia), [2]Russian National Research Medical University named after N.I. Pirogov, (Moscow, Russia)

Disclosures

Nothing to disclose

Relevance

The thromboembolic complications occur in 1-2% of all hospitalized patients,

cause more than 10% of all deaths,

are the leading cause of death in hospitalized trauma patients.

Stein P.D. et al., Chest 2011 Jun;139(6):1317-21.

The generally accepted methods of prevention of thromboembolic complications

Drug prevention

Compression knitwear

Early activation of the patient

Intermittent pneumocompression

Passive movements

Barrera L.M. et al., Cochrane Database Syst Rev 2013 Mar; 28;3.

HOWEVER!

None of these methods does not use the most important mechanism in ensuring normal physiological conditions,
the outflow of venous blood –
the work of the muscular-venous pump of the shin.

Methods for the prevention of thromboembolic complications in trauma patients under external fixator or skeletal traction?

Drug prevention - **yes!**

Compression knitwear **??**
Early activation of the patient **??**
Intermittent pneumocompression **??**
Passive movement **??**

Relevance

Despite all prevention methods over the past decade in the world
rate of deep vein thrombosis
increased by **3.1** times,
the incidence of pulmonary embolism
increased by **2.5** times

Mokhitary M. et al., Thromb Res 2014 Apr;133(4):567-73

Indirect Electrical Muscle Stimulation (EMS)



The most effective way of stimulating muscle pump and prevention of venous stasis

Kaplan R.E. et al., Thromb Haemost 2002 Aug; 88(2)200-4
Griffin M. et al., Eur J Vasc Endovasc Surg 2010 Dec;40(6):766-71
Czyrny J.J. et al., Vascular 2010 Jan-Feb; 18(1):20-7

Indirect Electrical Muscle Stimulation

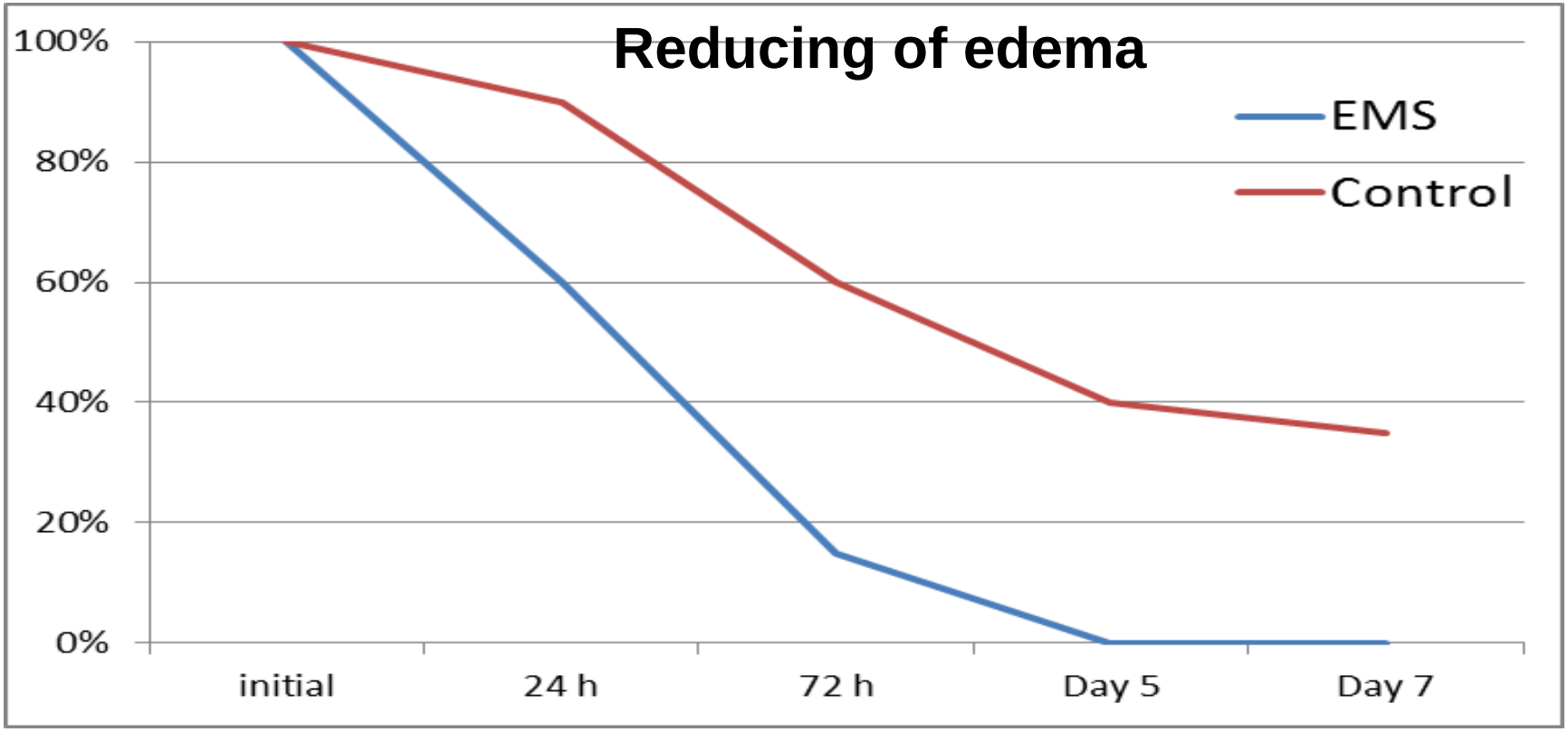
"Training walk" in the conditions of immobilization of the limb:

- **the elimination of edema and lymphedema**
- **improvement of venous outflow**
- **the increase in arterial inflow**
- **improvement of microcirculation**
- **the increase of circulating blood volume in the limb**
- **prevention of thromboembolic complications**

Own research: EMS in treatment of patients with diabetic foot syndrome (2010)

24 patients (56,1 ± 2,6 years) - an edema of the afflicted limb

14 patients – EMS, 10 patients – Control

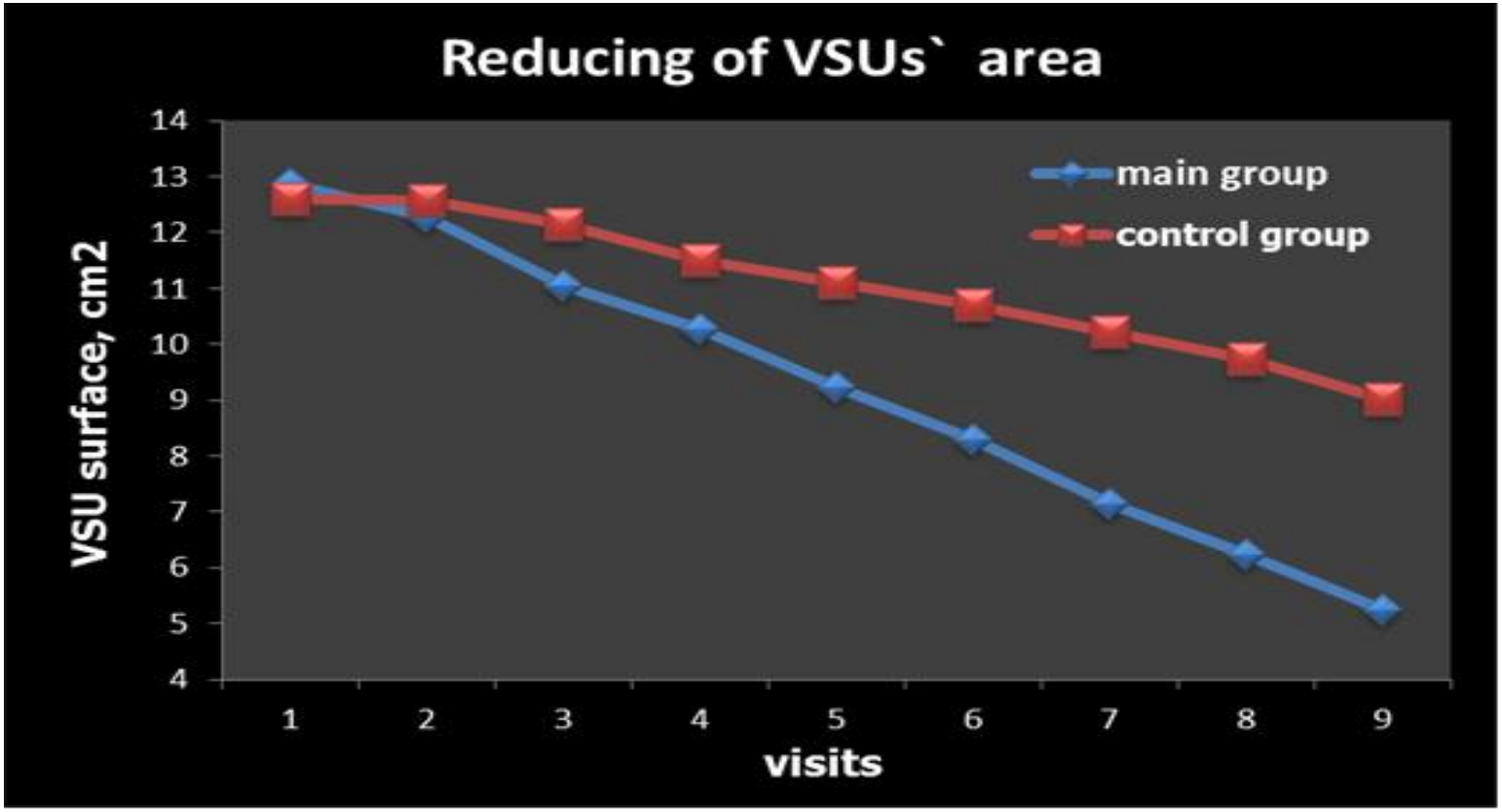


Leval P., Obolensky V., Nikitin V. EWMA Journal 2012.

Own research: EMS in treatment of low physical activity patients with venous stasis ulcers (2010)

45 patients (74,7 ± 3,6 years) - low physical activity, VSU

30 patients – EMS, 15 patients - Control



Leval P., Nikitin V., Obolensky V. EWMA Journal 2012.

Own research: EMS in prevention of thromboembolic complications (2012)

60 patients (63,2 ± 12,1 years)

Long operational manual (4.0 ± 1.2 hours)

The high risk of thromboembolic complications

	EMS group (n=30)	Control group (n=30)
Deep vein thrombosis of the shin without signs of pulmonary embolism	**1 (3,3%)**	**10 (33,3%)**
Thromboembolism of pulmonary artery branches	**0**	**2 (6,7%)**
	p=0,008	

Lobastov K., Barinov V., Laberko L., Obolensky V. et al., Int Angiol 2014 Feb;33(1):42-9.

EMS in trauma patients?



PURPOSE OF THE STUDY

Evaluate the effectiveness of indirect electrical muscle stimulation (EMS) in the prevention of thromboembolic events (TE) and reduction of terms of treatment and rehabilitation of patients with fractures of the shin bones (FSB).

V.N. Obolenskiy, A.V. Karpenko / Wound Medicine 2014;5:25-28

MATERIALS AND METHODS

A prospective randomized controlled trial

60 patients with closed fractures of the tibia (segment 4 on the classification of AO/ASIF)

Timing of the injury –
0.5 to 3.0 hours



MATERIALS AND METHODS

The treatment algorithm of all patients:

1. Stabilization of the fracture - external fixator or skeletal traction
2. Assigning low molecular weight heparins
3. After the relief of edema - the final reduction and fixation (intramedullary or extramedullary) under the control of image intensifier

MATERIALS AND METHODS

The treatment algorithm of all patients:

In cases of open fractures for the prevention of septic complications we use debridement & irrigation, the negative pressure wound therapy (NPWT) and antibiotic prophylaxis



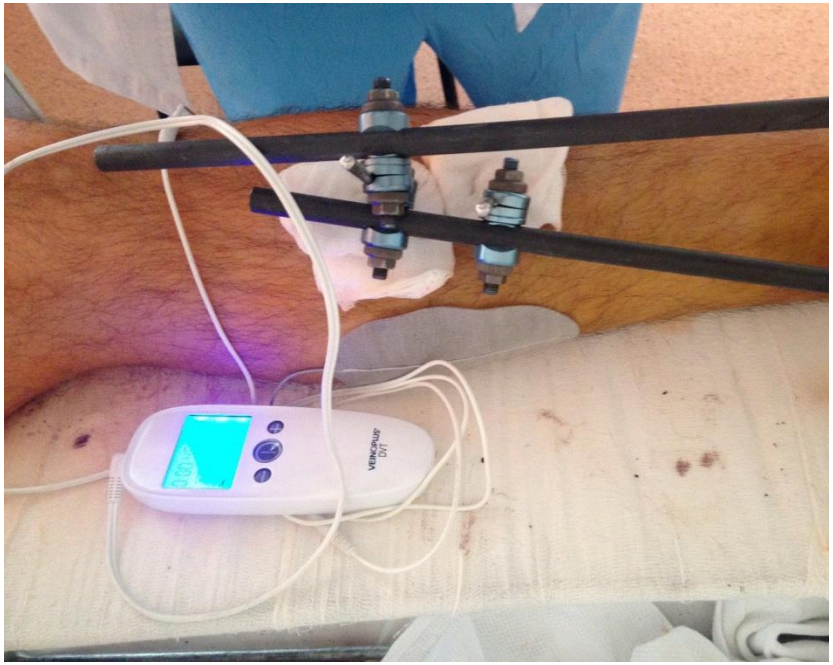
MATERIALS AND METHODS

Research Group
30 patients
(18 men, 12 women; mean age 42.4 ± 1.5 years) - 2 sessions EMS, 3 hours daily from the first day

Control group
30 patients
(17 men, 13 women; mean age 44.0 ± 2.2 years)

MATERIALS AND METHODS







RESULTS

	EMS group n=30	Control group n=30	p
The period of relief of the edema, days	5,1 ± 0,5	8,2 ± 0,7	< 0,05
The period until the final osteosynthesis, days	7,3 ± 0,7	10,4 ± 0,9	< 0,01
The duration of hospitalization, days	16,6 ± 1,0	17,7 ± 1,3	0,02
The frequency of thromboembolic complications	0	2 (14,3%) 1- a fatal pulmonary embolism	< 0,001

RESULTS

	EMS group n=30	Control group n=30	p
The increase in the index of the SF-36 to the 5th day after the final osteosynthesis	24,9%	14,5%	< 0,05
The increase range of motion (flexion) after the final osteosynthesis	71,9%	16,7%	< 0,01
The increased range of motion (extension) after the final osteosynthesis	194,1%	10,2%	< 0,002

DISCUSSION

The use of this technology allows to quickly arrest the peripheral edema and thereby reduce the time of the final osteosynthesis.

The muscle training in conditions of immobilization of the limb does not allow to develop the atrophy and thereby shortens the rehabilitation period.

CONCLUSIONS

Application of the methodology EMS managed to avoid thromboembolic complications, improve the quality of life of the patients during hospital stay, reduce the period of treatment and rehabilitation.

Acknowledgements

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Trauma surgeons – A.V. Karpenko[1,3], An.A. Semenisty[1,4]

Nurses – all nurses in surgery/trauma/orthopedic units[1]



[1]City Hospital #13 (Moscow, Russia), [2]RNRMU (Moscow, Russia), [3]RUFP (Moscow, Russia), [4]1st MSMU (Moscow, Russia)

Thank you for your attention !

