ROLE OF FUNCTIONAL ELECTRICAL STIMULATION IN THE PROPHYLAXIS OF THROMBOEMBOLIC COMPLICATIONS

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Abstract – Peripheral circulation fails during laparoscopic cholecystectomies due to various reasons: pneumoperitoneum, Virchow triad, curare effects of myorelaxation. This leads to increased incidence of thromboembolic complications. We suggested functional electrical stimulation of thromboembologenic areas as m. triceps surae to prevent those complications.

Keywords: 1. Functional electrical stimulation, FES, electromyostimulation, 2. Peripheral circulation, peripheral blood flow, 3. Laparoscopic cholecystectomies, 4. Thromboembolic complications, 5. Venous occlusion plethysmography, 6. Electromyotonometry, 7. Myorelaxants, 8. Virchow triad.

1. Introduction

Videolaparoscopic operations have gained a wide popularity [3] though they carry a substantial risk of thromboembolic complications due to additive effect of pneumoperitoneum and anaesthesia on the reduction of blood flow in the lower part of the body [3, 4, 5]. Opinions on traditional antithrombolic prophylaxis remains still controversial [2, 5, 6].

Aim of the study: to evaluate the effect of functional electrical stimulation (FES) in the area of m. triceps surae on blood flow in the legs.

2. Methods

The surgery was performed by using standard endotracheal anaesthesia. The functional electrostimulation of sural muscles was accomplished by using assimetric, bipolar, equal fields electric pulses, produced by "Myorhythm-021" apparatus. The frequency of pulses was 70 Hz, the amperage – 20 ÷ 100 mA (according to the level of myorelaxation). The procedure was continued during all the time of operation.

26 patients scheduled for elective videolaparoscopic cholecytectomy were included in the study. 56 examinates of peripheral circulation and 520 measurements of muscle tone and elasticity were accomplished by personal agreement of the patients. They were randomly assigned into groups according intraoperative antithrombolic prophylaxis: group 1 – FES in the area of m. triceps surae, group 2 – traditional measures, group 3 – no prophylaxis. Peripheral blood flow, muscle tone and elasticity was evaluated during most characteristic moments (1. After intubation – 0.0 ± 0.0 min; 2. Start of pneumoperitoneum – 18.00 ± 1.69 min; 3. Obliteration of ductus cysticus – 32.0 ± 2.91 min; 4. After the desuflation – 55.0 ± 5.06 min; 5. Extubation – 73.5 ± 5.97 min) of surgical intervention by venous occlusion plethysmography and electromyotonometry of m. triceps surae.

3. Results

Group 1 demonstrated positive effect of FES on the parameters of m. triceps surae blood flow and tone which frequently differed significantly ($p \leq 0.05$) from group 2 and 3. For example, in the group of functional electrical stimulation [1] at the and of surgery (73.5 ± 5.97 min) peripheral circulation exceeded the control level in 31.2 ± 21.25% ($p < 0.05$). Muscle tone (8.75 ± 3.75%) and muscle elasticity - (decrement – 20.00 ± 8.00%, $p < 0.05$) exceeded the control level in the same group [1].

Results of our research work established the validity of hypothesis concerning the effectiveness of electrostimulation of surae muscles in restoring of injured circulation following surgery. The circulation and function of sural muscles of the 1 group at the and of operation were similar to the control level and completely different from the rest – 2,3 groups. The same results were achieved during urologic surgery [1] and were identical to other references [1, 2, 6, 17].

The essence of the electrostimulation is the restoring of neuromuscular synapsis of sural muscles (where is the center of venous-muscular pump) and as a result decreasing of venous haemostasia in the shin – most dangerous region for formation the thrombols. The measurement of peripheral circulation proved this as well as electromyotonic data at the end of surgery.

4. Conclusion

FES can be recommended as a routine intraoperative antithrombotic prophylactic measure especially in the population with high risk of thromboembolic complications.

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