

RECOVERY OF ELECTRICAL ACTIVITY OF ANTERIOR ABDOMINAL WALL MUSCLES AFTER PROLONGED ATROPHY

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It was shown that the functional state of the muscles of the anterior abdominal wall can be restored, as reflected in the parameters of their electrical activity, after prolonged atrophy due to a giant ventral hernia. A fuller recovery of the electromyographic indices is found if the anterior abdominal wall is reinforced with synthetic prosthetic material, for under these circumstances the muscle fibers are not caught up by the sutures and are in a functionally advantageous position.

KEY WORDS: prolonged atrophy; anterior abdominal wall muscles; hernia and its cure.

The use of electromyography to determine the functional state of skeletal muscles is now widespread [7, 5, 6, 9].

Investigations [2, 3, 8] have shown a direct relationship between the strength of muscular contractions and the average amplitude of electrical activity recorded by skin electrodes. This suggests that the method of electromyography can be used to assess the functional state of the anterior abdominal wall muscles when a hernia is present and after its cure. Only one short report on this problem could be found in the literature [4].

The object of this investigation was to determine the functional state of the anterior abdominal wall muscles as reflected in the parameters of electrical activity in patients with giant ventral hernias and after their surgical treatment by autografting or by alloplastic repair of the anterior abdominal wall.

EXPERIMENTAL METHOD

Electrical activity of the muscles was studied by recording activity from the external oblique and rectus abdominis muscles by means of skin electrodes, with an area of 5 mm², and at a distance apart of 45 mm, on a two-channel Medicor electromyograph. Depending on the location of the hernia, the electrodes were applied symmetrically to the external oblique or rectus abdominis muscles. Muscles of the abdominal press were activated by a series of exercises with the patient lying on his back. To discover the points of the muscle with greatest electrical activity, alternate leg raising exercises were carried out, and to record the EMG simultaneously from symmetrical points of the external oblique and rectus muscles, both legs were raised together. The speed of the movements was 20-25 elevations per second. Curve of the hernia and strengthening of the anterior abdominal wall by auto- or autoalloplasty followed the technique described previously [1].

EXPERIMENTAL RESULTS

Analysis of the EMG curves showed that in all patients with giant lateral hernias marked asymmetry of electrical activity of the anterior abdominal wall muscles was observed before the operation, with a decrease to 30-100 μ V on the side of the lesion, whereas electrical activity of the muscles of the healthy side varied from 300 to 900 μ V. Electrical activity of the muscles in patients with a median hernia was reduced equally on both sides to 100 μ V or less.

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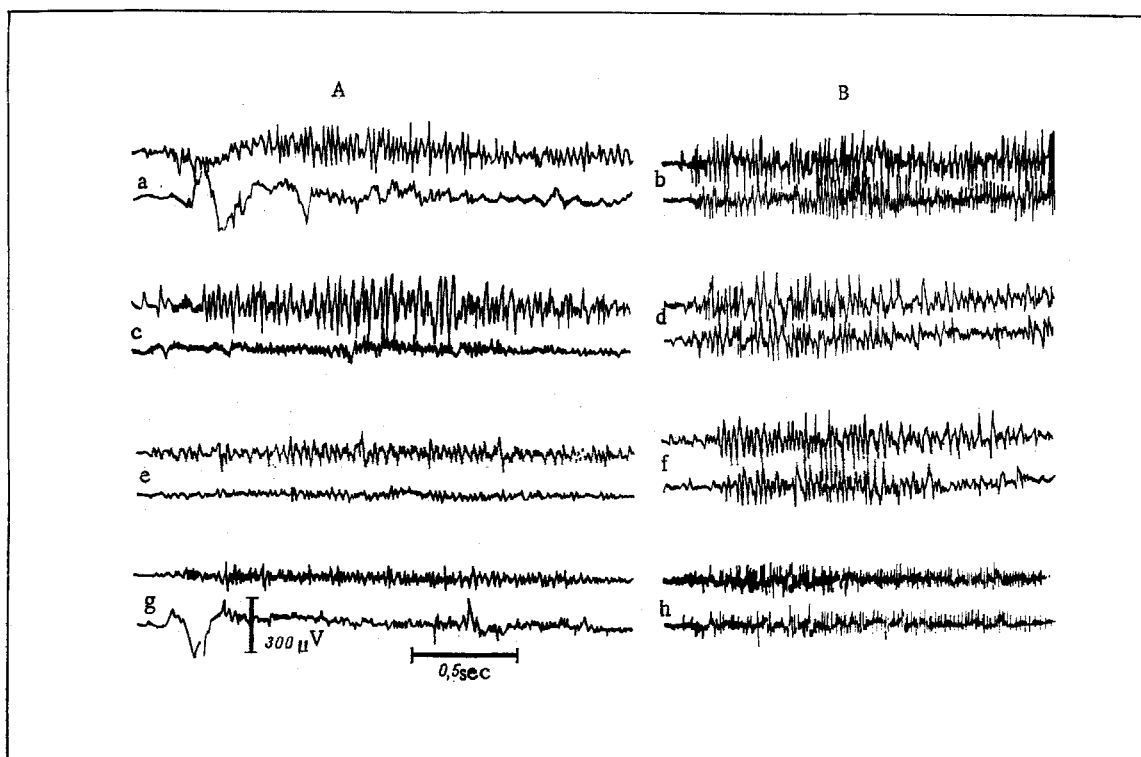


Fig. 1. EMG of anterior abdominal wall muscles of a patient with giant hernia (raising both legs simultaneously in recumbency). A: a, c) Hernia located in right iliac region before operation; B: b, d) the same, after operation with autoalloplastic strengthening of anterior abdominal wall; A: e, g) patient with ventral midline hernia before operation; B: f, h) the same after operation with autoplasmic strengthening of anterior abdominal wall.

After the operation of autoplasmic strengthening of the anterior abdominal wall with local tissues, recovery of the amplitude of the EMG on the side of the operation was observed after one month, when the indices came close to those for the healthy side. However, in 6 of 10 patients studied, the amplitude of the EMG after the operation on the side of the hernia did not reach the original values on the healthy side.

After autoalloplasty of the anterior abdominal wall using knitted Lavan gauze fabric, the EMG amplitude on the side of the operation recovered more rapidly, so that in the third week of the postoperative period the amplitude of the EMG was equal to the original values on the healthy side. Recovery of the EMG in this way was observed in five patients after autoalloplastic strengthening of the anterior abdominal wall, and only in one patient were asymmetrical values of the EMG still observed on account of a persistent serous effusion in the postoperative period, but the amplitude of the EMG on the side of the graft increased nevertheless from 80 to 200 μ V by the end of the 4th month. In all patients the frequency characteristics of the EMG showed no significant changes.

The EMGs of patients with a giant hernia in the right iliac region before the operation are illustrated in Fig. 1A (a, c). Asymmetry of electrical activity reflects the functional state of the anterior abdominal wall muscles on the side of the lesion (bottom beam) and on the healthy side (top beam). After plastic repair of the anterior abdominal wall by means of a synthetic implant as described above, recovery of the EMG was observed on the side of the operation in these patients by the 3rd-4th week. In Fig. 1B (b, d) the curves are completely symmetrical and the combined amplitude of electrical activity after the operation is equal to the averaged amplitude of the EMGs recorded before the operation on the healthy side.

EMGs of the rectus abdominis muscles of patients with a giant median hernia before the operation are illustrated in Fig. 1A (e.g.). A decrease in the amplitude of electrical activity together with marked asymmetry, indicating impairment of the functional state of the rectus abdominis muscles, more marked on the right, can be clearly seen in the curves. After autoplasmic strengthening of the anterior abdominal wall, increased electrical activity of the rectus muscles

was observed, but the degree of the increase was less marked than in the first group of patients (Fig. 1B: f, h).

The more rapid and complete recovery of combined electrical activity of the anterior abdominal wall muscles after herniotomy accompanied by autoalloplastic repair with knitted Lavsan gauze fabric thus indicates that the anterior abdominal wall muscles recover their functional properties and that the allograft and the capsule forming around it have no atrophic effect on the muscle; these findings, in turn, indicate that allografting of the anterior abdominal wall is a physiologically correct and adequate procedure. Defects of the anterior abdominal wall in patients undergoing autoalloplasty, incidentally, were much greater than those in patients treated by autoplasty, but the EMG indices were nevertheless restored more completely after the operation in the patients of the first group.

It can be concluded from this investigation that autoalloplasty of the anterior abdominal wall has definite advantages in patients with giant ventral hernias over autoplasty, when the sutured muscle fibers are in a functionally less advantageous state.

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MECHANISM OF THE ANTIEXUDATIVE ACTION OF HEPARIN

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In experiments on rats inflammation of the skin was induced by application of xylene. Exogenous and endogenous hyperheparinemia was shown not to affect the dynamics of the microcirculatory changes in the zone of inflammation in the initial stage of its development and vascular permeability was significantly reduced. It is suggested that a decrease in vascular permeability plays the main role in the mechanism of the antiexudative action of heparin.

KEY WORDS: heparin; capillary permeability; microcirculation.

One of the many biological effects of heparin is its antiexudative action [7, 8]. The leading factor in the mechanism of exudation, of course, is increased capillary permeability. The effect of heparin on vascular permeability in inflammation has been inadequately studied and data in the literature on this matter are contradictory [1, 2, 6].

The object of this investigation was to study the effect of exogenous and endogenous hyperheparinemia on vascular permeability and on the dynamics of changes in the microcirculation in an inflammatory focus.

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