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REGIONAL MUSCLE TENSION AND PAIN ("FIBROSITIS")

Effect of Massage on Myoglobin in Plasma

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ABSTRACT. In thirteen patients, all women, with regional muscle tension and pain ("fibrositis") plasma myoglobin concentration was measured before and after massage. A significant increase was observed in the plasma myoglobin concentration reaching a maximum three hours after the start of massage treatment (median 133 μg/l). A positive correlation was found between the degree of muscle tension and the increase in plasma myoglobin concentration. After repeated massage treatment a gradual decline could be demonstrated in the increase of the plasma myoglobin concentration in coincidence with the efficacy of the treatment. Opposed to this only normal levels of myoglobin were found in plasma when muscles without tenderness and pain were treated with massage. The observed increase of myoglobin in plasma after massage indicates a leak of myoglobin from the muscle fibres, which suggests that regional muscle tension and pain is associated with disorders in the muscle fibres.

Key words: Myoglobin, massage, muscle pain, muscle tension, fibrositis

Muscle pain is a very common phenomenon, resulting in reduced activity and movement. The term "muscular rheumatism" was introduced in 1900 by Adler in case histories (2). Later many names have been applied to this painful clinical condition: fibrositis (1, 6, 10, 21), fibrositis syndrome 13, 16, 18), interstitial myofibrositis (3), myofascial pain syndrome (4, 8), myofascitis (20), myalgia or myalgic spots (23) and trigger points (7, 22).

Muscle pain combined with nodular changes might be either secondary to joint diseases or a primary fibrositis characterized by the following five criteria: 1) duration of muscle symptoms more than 3 months, 2) typical sites of deep tenderness—trigger point—localized to muscle insertions, 3) skin roll tenderness, 4) disturbed sleep and 5) normal ESR, SGOT, ANF and rheumatoid factor (19). No essential histological and biochemical abnormalities have been found in patients suffering from muscle pain syndrome (18). It has been postulated that the muscle pain is due, not to changes in the muscle fibres, but to inflammation in the involved tendons (11). So far investigations of the involved muscles have been discouraging. There has been some evidence that the oxidative metabolism in the muscle fibres of painful muscle areas is somehow abnormal (9).

Myoglobin is a protein with a molecular weight of 17000 Dalton. It is localized in the muscle tissue, where it is considered to be a link in the oxygen transport (12).

The aim of this study was to measure the changes in plasma concentrations of myoglobin and the muscle enzymes, lactate dehydrogenase (LD) and creatine kinase (CK) in connection with massage treatment of regional muscle pain.

MATERIAL AND METHODS

Thirteen consecutive patients, all women (median age 31, range 24–55 years), with muscle pain and tension localized to shoulder regions or back participated in the study. Median weight of the patients was 58 kg (range 51–75).

The patients were without signs of illness. No medication and no physical treatment were given during the study. The patients received massage from 30 to 45 min ten times evenly distributed over a period of four weeks. The massage was given by the same physiotherapist during the whole study. Before the first, fourth, seventh and tenth treatment the physiotherapist measured and marked the areas of tender muscles on an anatomical map, where the back was divided into eight regions i.e. shoulder-girdle, upper back, lumbar region and buttock on both sides.

A scale, reflecting the size of the tension areas, 0 to 3 was used. 0 indicated normal muscle, 1: tension area with a diameter of 0–2 cm, 2: a diameter of 2–5 cm and 3: a diameter of more than 5 cm. The score values from each of the eight areas were added to give index of "fibrositis"; highest obtainable index was twenty-four.

Venous blood samples were drawn before and one, two, three, four, five and six hours after the first massage

Table I. *The increase of plasma concentration of myoglobin due to massage treatment and a "fibrositis" index proportional to the extent of muscle tension before treatment is given for the first, fourth, seventh and tenth treatment of thirteen patients*

The control group consisted of the same patients given massage to femoral and gastrocnemic muscles

Treatment no.	Increase in concentration in plasma myoglobin (μg/l)			Index of "fibrositis"		
	Median	Range		Median	Range	
1	133	35–504	$p<0.01$	12	3–21	NS
4	50	0–91	$p=0.02$	9	3–15	$p<0.01$
7	28	11–110	NS	6	2–11	$p<0.02$
10	7	0–73	NS	3	0–6	
Control	13	0–38		0		

treatment. At the following treatments samples were drawn only before plus one and two hours after.

A control massage was given to muscles without signs of muscle pain and tension. In order to treat a somewhat comparable muscle mass the femoral and gastrocnemic muscle were treated for 30 to 45 min.

Analytical methods

The concentration of myoglobin in plasma was blindly measured by radioimmunoassay (12). All chemicals used were of an analytical grade. The iodinated myoglobin was delivered from CIS (®) (MYO-125-A), the myoglobin antibody from Behringwerke (OTPK 05).

Concentrations of LD and CK were measured according to Scandinavian recommendations (17).

Plasma samples were frozen at −20°C until analysed, i.e. for one month at the most. Analyses for LD were performed on the day of sampling.

The intra-assay coefficients of variation were 6% for myoglobin 2% for LD and 4% for CK.

Wilcoxon matched paired signed ranked sum test and Spearman's ranked sum correlation test were used for statistical analysis.

RESULTS

The variations in plasma concentrations of myoglobin before and after the first, the tenth massage treatment and in the control treatment are seen in Figs. 1 and 2.

As can be seen in Fig. 1 plasma myoglobin concentration rose after massage treatment reaching a peak value within 3 hours ($p<0.01$). Opposed to this no such change was seen after the tenth massage treatment or in the control situation. In one of the patients the maximum concentration of plasma myoglobin was not reached until 4 hours after the start of the massage. This maximum was 30% higher than the 3 hours value.

From treatment to treatment there was a gradual, significant decline in the raise of plasma myoglobin until the seventh treatment and no difference between the seventh and the tenth treatment. There was a significant difference between the increase of plasma myoglobin after both the first and the fourth treatment when compared to the increase after massage treatment of the femoral and gastrocnemic muscles ($p<0.01$), while no differences were found in the myoglobin increase between the seventh or

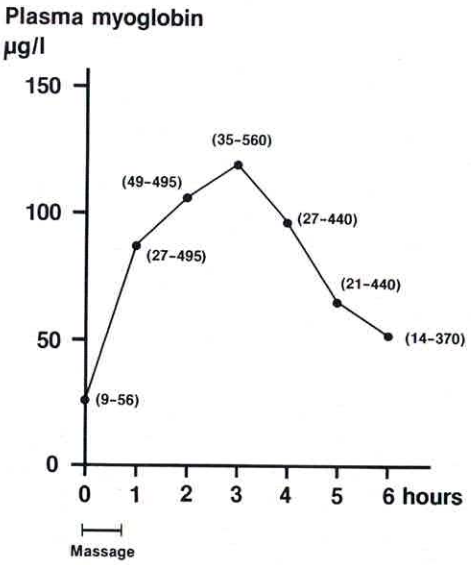

Fig. 1. The concentration of myoglobin in plasma before and after the first treatment with massage of thirteen patients. Median values are given with corresponding ranges in brackets.

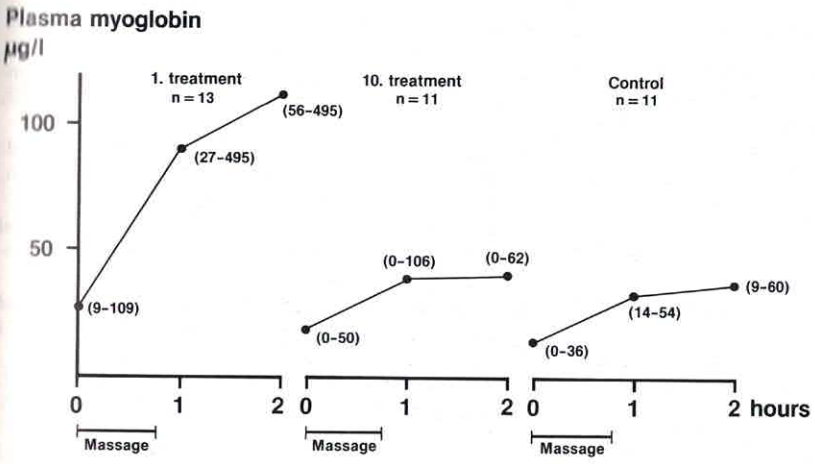

Fig. 2. Rise in plasma myoglobin concentration due to massage given for the first, the tenth and control treatment. Median values are given with corresponding ranges in brackets.

the tenth on the one hand and the control treatments on the other.

The median index of "fibrositis" index decreased gradually from treatment to treatment. The improvement was significant between the fourth and the seventh treatment ($p<0.02$) (Table I). The increase of plasma concentration of myoglobin after massage treatment was significantly and positively correlated to the estimated "fibrositis" index ($p<0.05$).

No correlation was found between the muscle mass—roughly expressed by the body weight—and the increase in the plasma concentration of myoglobin after treatment with massage.

The level of the plasma concentration of LD (median 360 U/l, range 300–520) did not change at all in relation to the treatment. The concentration of CK (median 76 U/l, range 45–102) rose slowly during six hours to approximately twice the initial value (median 126 U/l, range 44-446).

DISCUSSION

This study demonstrates that massage treatment provokes an increase in the plasma concentration of myoglobin. This increase is correlated to the index of "fibrositis". Repeated massage treatment is followed by a gradual decline in the increase of plasma myoglobin to a level not differing significantly from that reached by massage of a comparable muscle mass without muscle pain and tension. The changes in plasma myoglobin are independent of total muscle mass. The increase of myoglobin in plasma after massage treatment does not seem to be due to mechanical destruction of the muscle tissue, as the plasma changes decrease after repeated massage treatment and as no changes were observed when normal muscles were treated. This suggests that regional muscle pain is a disorder of the muscle fibres rather than a disease of the connective tissue.

This assumption is not contradictory to the histologic studies of Brendstrup et al. who demonstrated slignt inflammatory changes in the muscle tissue in case of muscle tension (5).

Fassbender examined biopsies from the trapezius muscle from patients with "muscular rheumatism" by using an electron microscopic technique. He found degenerated mitochondria and increased glycogen deposits in the muscle fibres, which to him indicated that the primary cause of muscle rheumatism is hypoxia resulting in loss of mitochondrial function and therefore loss of oxidative metabolic capacity in the muscle (9).

From studies on myocardial infarction it is known that peak levels of myoblobin appears few hours, peak levels of CK more than 6 hours and peak levels of LDH more than 24 hours after infarction (14). The modest increase of CK and the lack of increase of LDH is therefore to be expected during these experiments.

The correlation between the "fibrositis" index and the plasma myoglobin increase indicates that the tension of the muscles might be objectively described.

In agreement with Krusen (15) and with the results of Fassbender, we conclude that massage tends to normalize muscle tension. The efficacy might be estimated by both the posttreatment plasma myoglobin concentration and by the index of "fibrositis".

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