Physiological effects of local heat application in physical therapy

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Introduction
Local heat application in physical therapy is often considered as a contraindication for cardiovascular diseases. It is a general belief that hot packs and hot mud applications (fango) have an effect on heart rate and blood pressure, which could lead to severe symptoms in particular by cardiovascular patients.

In two preliminary studies on healthy subjects (n=20) we found no influence of local heat therapy (Fomentec and mud pack) on heart rate and blood pressure. The aim of this study was to investigate the physiological effects (core temperature, stroke volume, cardiac output, rate pressure product) of local heat application by hot mud packs (fango) on the human body.

Methods
Ten healthy subjects (7 women, 3 men) volunteered in this study (age 25.8 ± 2.7 yrs). Heat therapy was applied on the back of the subjects, using a 1 cm thick parafin mudpack with a 2500 cm² surface at 42°C. Subjects were lying on their back covered by a blanket during twenty minutes before testing. Fango was applied during 21 minutes. After heat application subjects stayed in supine position for further 21 minutes. The following variables were measured every three minutes before, during and after heat application: body temperature, heart rate, diastolic and systolic blood pressure (Omron), stroke volume, cardiac output and rate pressure product (Siemens Acuson CV70 Ultrasound).

Results
Mean resting heart rate (HR) was 74.5 ± 5.3 bpm. During heat application HR increased and peaked after three minutes (79.1 ± 11.7 bpm; p<0.05). At the end of fango application HR decreased (76.9 ± 11.4 bpm). Mean HR rate decreased further within 6 minutes after cessation fango application (74.3 ± 11.0 bpm; p>0.05). 18 to 21 minutes post-application HR reached baseline level (74.5 ± 11.7 bpm; p>0.05).

Mean resting systolic blood pressure (SBP) was 125.4 ± 1.50 mmHg. After six minutes fango application SBP decreased (119.6 ± 6.2 mmHg; p=0.031). At the end of the post-application period SBP was at nearly at baseline level again (123.1 ± 8.8 mmHg; p>0.05).

Mean resting diastolic blood pressure (DBP) was 71.9 ± 2.70 mmHg. DBP decreased within three minutes after fango was applied (69.6 ± 7.7 mmHg; p>0.05). After 12 minutes application time diastole blood pressure decreased (66.7 ± 11.2 mmHg; p=0.042) and at the end of the 21 minutes fango application period DBP was 70.0 ± 10.6 mmHg (p=0.898).

Baseline body temperature (BT) was 36.5 ± 0.1 °C. No changes in BT were observed during the whole application and post-application period (p>0.05).

Mean resting stroke volume (SV) was 59.5 ± 11.0 ml. SV increased after 3 minutes fango application (67.7 ± 22.1 ml; p>0.05). SV did not reach baseline values 21 minutes after removal of the mud pack (64.0 ± 21.3 ml; p>0.05).

Mean resting cardiac output (Q) was 4413.7 ± 1001.2 ml/min. During application Q increased immediately and peaked after 3 minutes (5300.5 ± 1650.3 ml/min; p<0.05). At the the end of the fango application Q decreased (4952.8 ± 1409.4 ml/min; p<0.05). MC decreased further within 3 minutes after fango application was stopped (4285.3 ± 1213.4 ml/min; p>0.05). After 18 - 21 minutes post-application Q was 4631.7 ± 1623.6 ml/min (p>0.05).

Baseline rate pressure product (RPP), as an estimation of myocardial flow was 9355.0 ± 1779.4 mmHg*bpm. During the application period RPP remained stable (p>0.05). After 21 minutes heat application RPP was 9323.1 ± 1583.9.4 mmHg*bpm (p>0.05). Compared to the baseline values, no RPP changes were found after removal of the fango (p>0.05).

Discussion
We conclude that local heat application resulted in weak overall systemic effects. Systolic and diastolic blood pressure remained stable while heart rate increased slightly. The latter may be provoked by a redistribution of the blood towards the more superficial veins as part of the thermoregulation response.

These findings are in agreement with the results of earlier studies (Taeymans et al., 2003).

Stroke volume, cardiac output and rate pressure product as an estimation of myocardial blood-flow were very stable. Our findings clearly demonstrate that local heat therapy (hot mud packs) has no major influence on cardiac functioning in healthy young subjects. Verification of a similar procedure in heart patients is required to exclude if CVD is really a contraindication for local heat (fango) therapy.

References