HYDROMECHANICS OF TISSUE EDEMA FLUID UNDER COMPRESSION BANDAGES

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Bandaging is an integral part of complex decongestive therapy of lymphedema. The conditions for effective bandaging are: generating tissue fluid (TF) pressures high enough to mobilize and propel fluid and maintain the on-limb elasticity of bandage material for hours, both at rest and during muscle contractions.

How high is the TF pressure at the site of application of bandages remains unknown. Moreover, it is unknown how much fluid moves proximally after applying bandage compression.

AIM

To measure simultaneously the subcutaneous TF and bandage-skin interface pressure, as well as TF flow after application of bandages, with increasing compression force.

METHODS

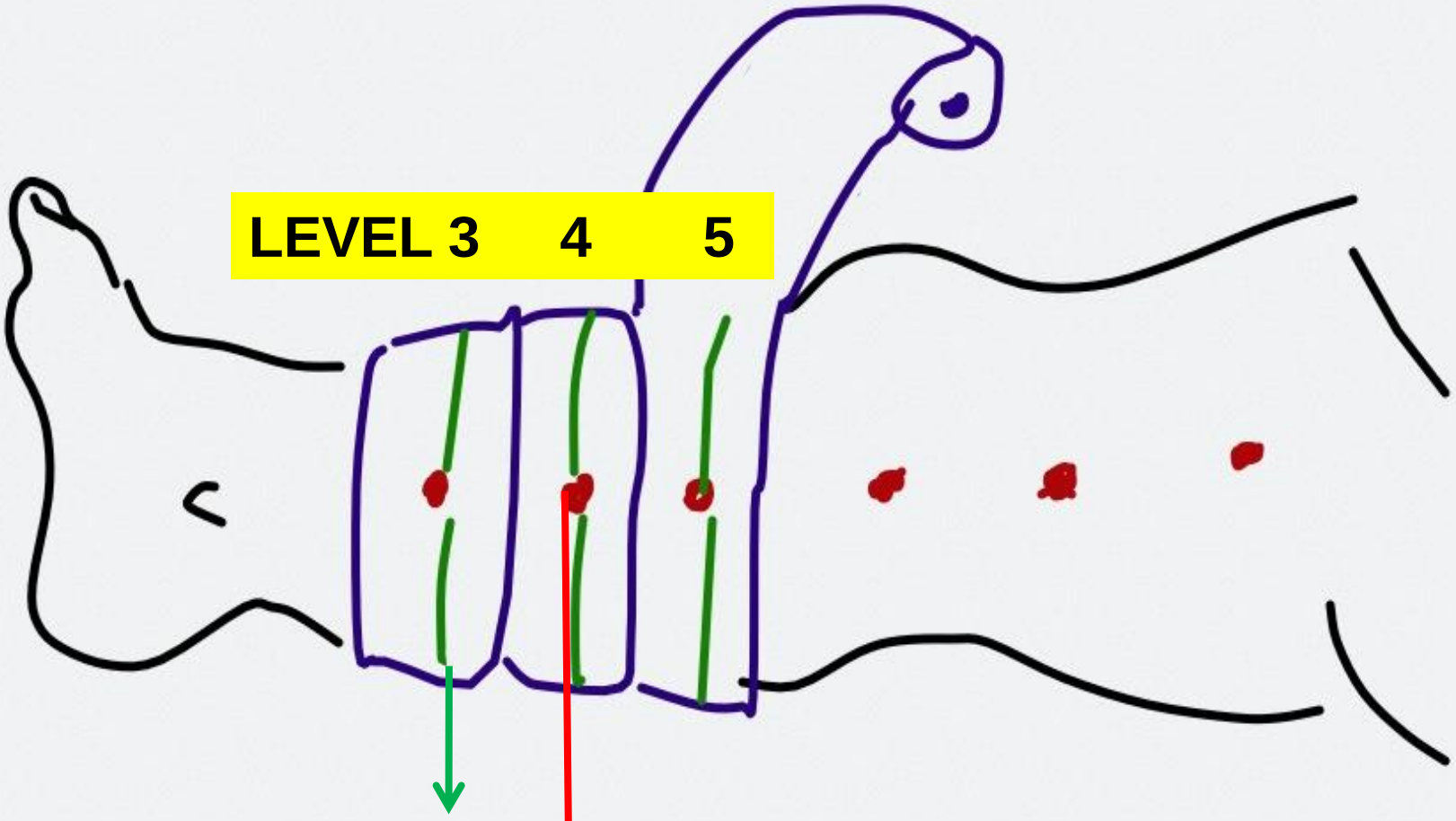
Twenty patients with lymphedema of lower limb stage II were investigated.

1.Bandage-skin interface and

2. tissue mobile fluid (TF)

pressures were measured after application of one and two layers of elastic or short –stretch bandages. TF flow was measured during bandaging with plethysmography.

BANDAGE



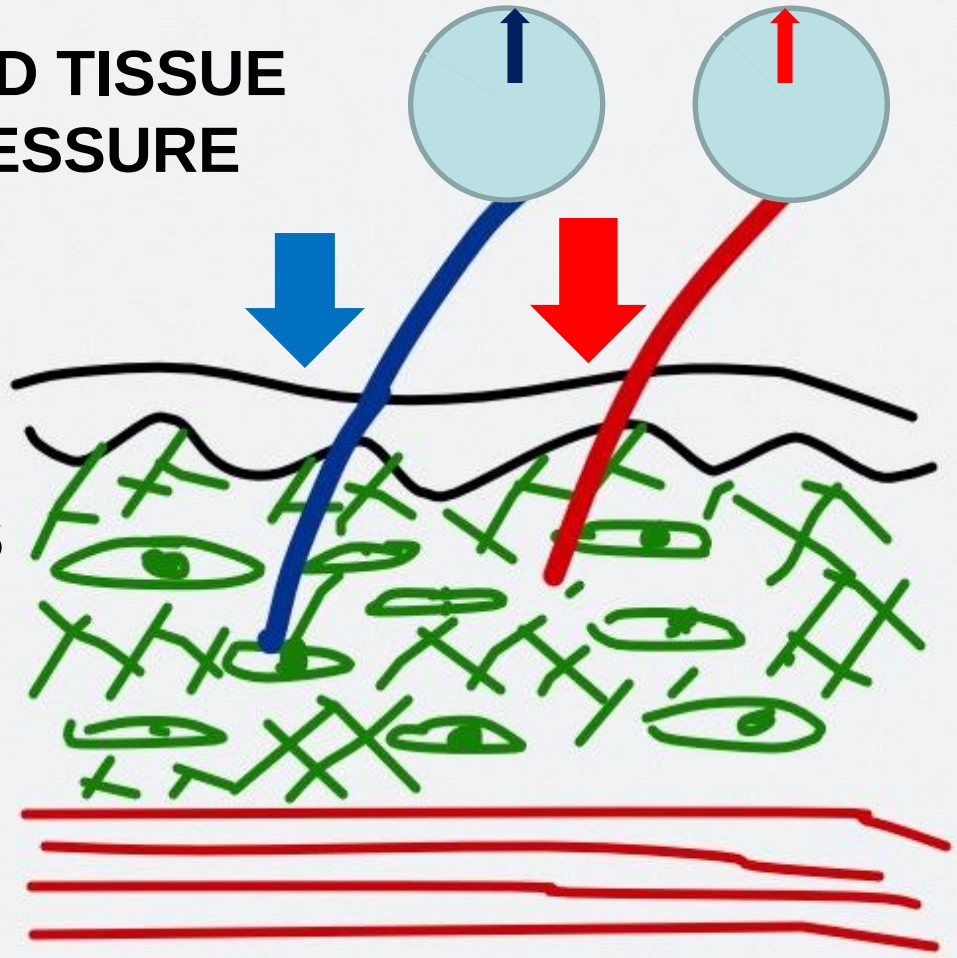
CIRCUMFERENCE

TISSUE FLUID PRESSURE and
SOLID TISSUE PRESSURE

FLUID FLOW

SOLID TISSUE PRESSURE

TISSUE FLUID PRESSURE

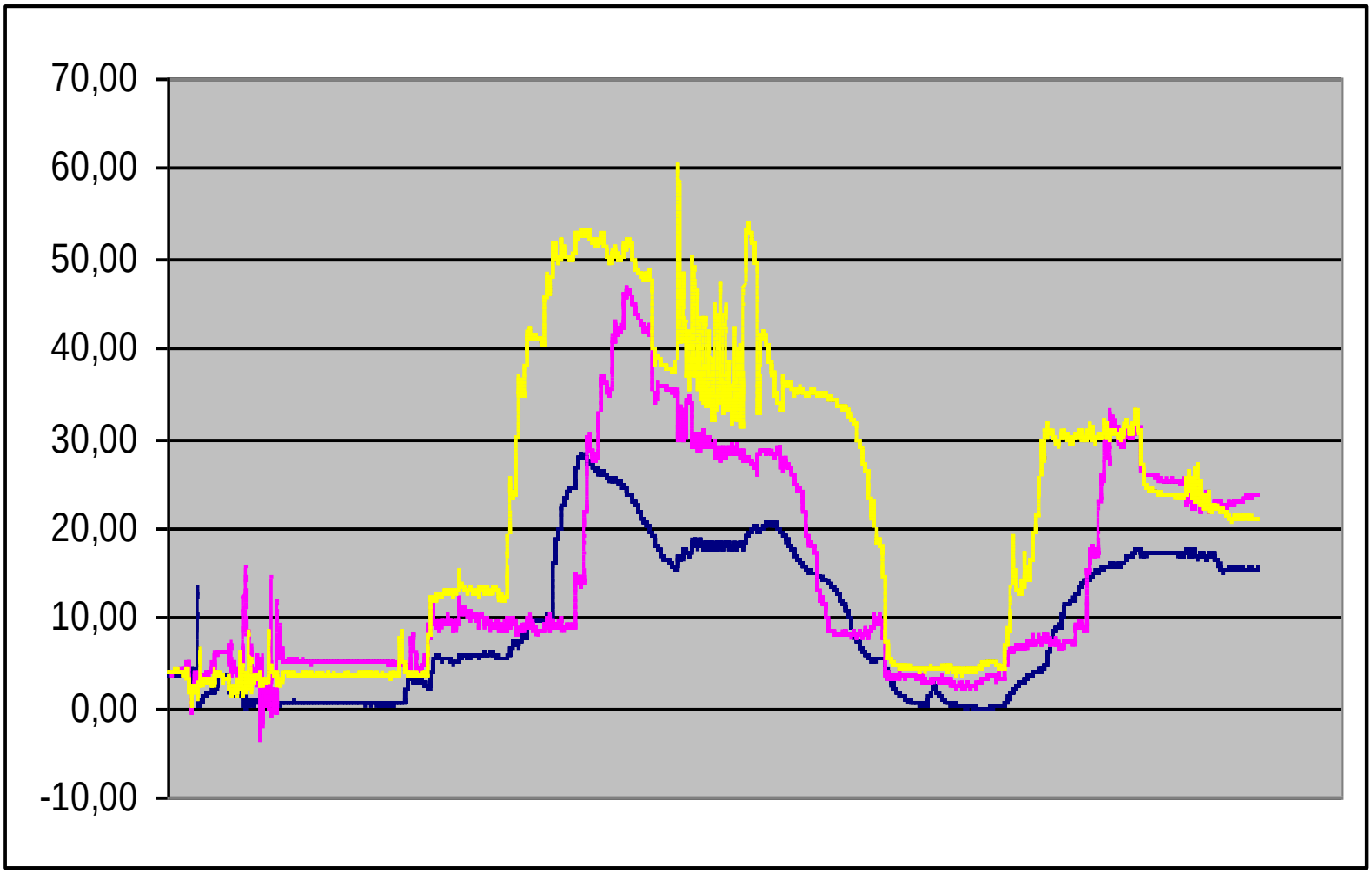


SUBCUTANEOUS TISSUE

LEG SOFT TISSUES

TISSUE FLUID PRESSURE

Bandaging COBAN calf level 3, 4, 5 led stage II, mmHg



COMMENTS

First wrap, one layer

Yellow –above ankle 50mmHg, spikes are foot movements, pressure drop in 5 min.,

Rosy- mid-calf , 40mmHg, pressure drop

Blue – below knee, 20mmHg, pressure drop

Different pressures at different leg level

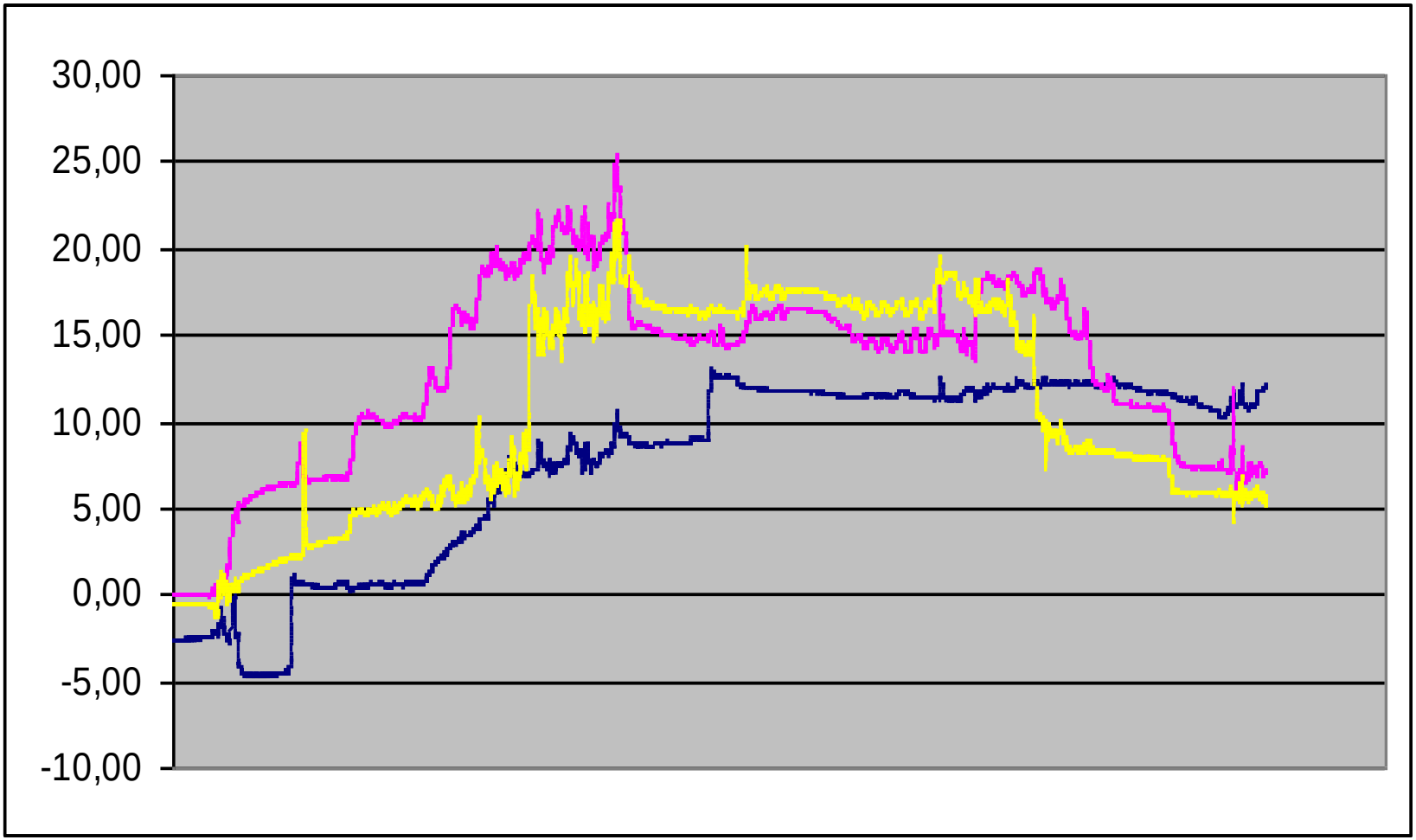
Foot movement waves 10 mmHg

Second wrap, one layer

Pressures of 30-10 mmHg, due to evacuation of edema fluid, proximal displacement of tissues and loss of bandage elasticity?

TISSUE FLUID PRESSURE

Bandaging COBAN thigh level 6, 7, 8 lymphed stage II, mmHg



COMMENTS

First wrap, one layer

Rosy –above knee 20 mmHg,

Yellow- mid-thigh , 20mmHg,

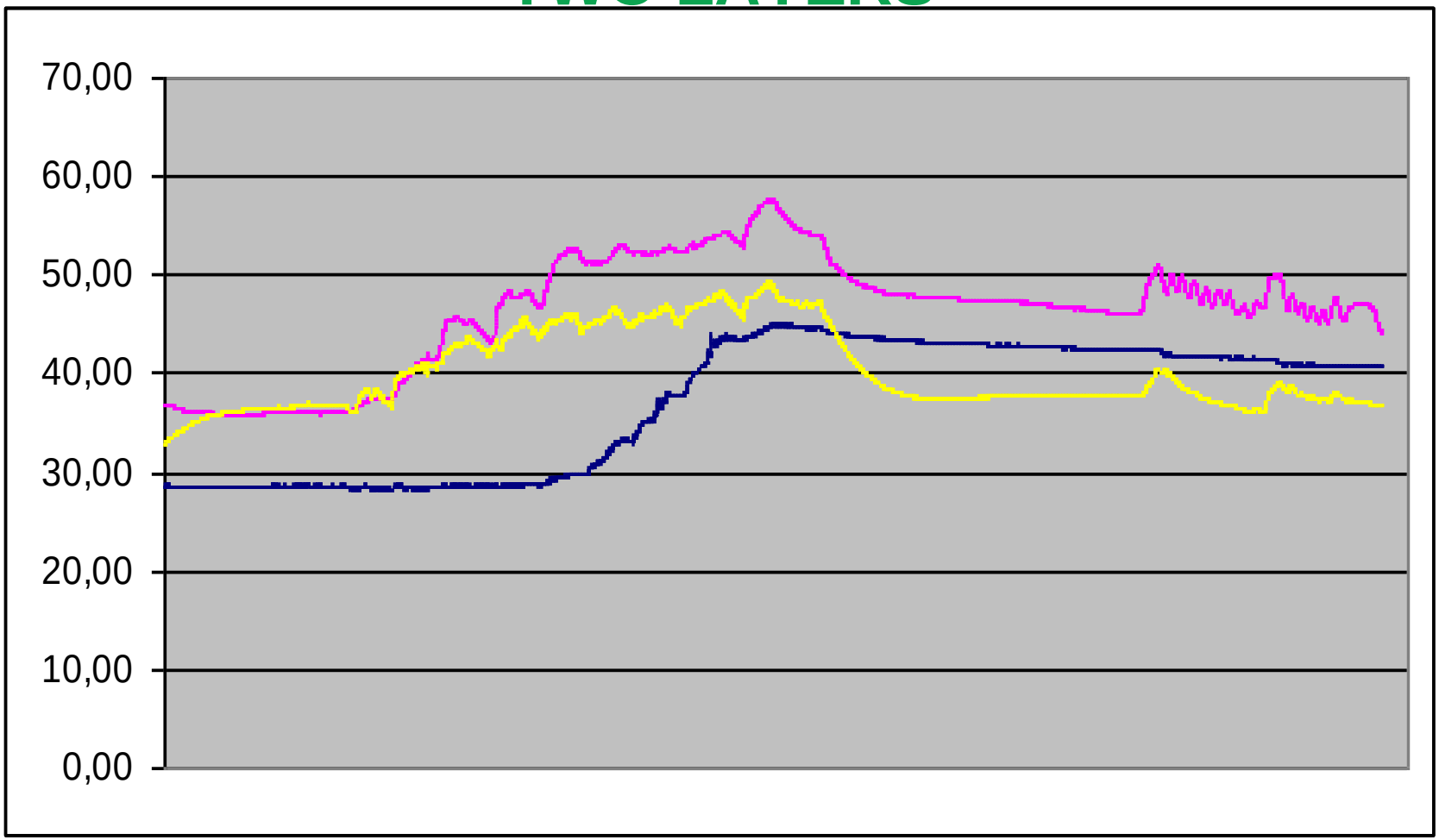
Blue – below inguinal fossa, 10mmHg,

Low TF pressure due to rapid force dissipation in soft thigh tissues and zero TF pressure in the non-compressed inguinal fossa region

TISSUE FLUID PRESSURE

Bandaging COBAN calf level 3, 4, 5 NDelhi 11/7/2011 led stage II, mmHg

TWO LAYERS



COMMENTS

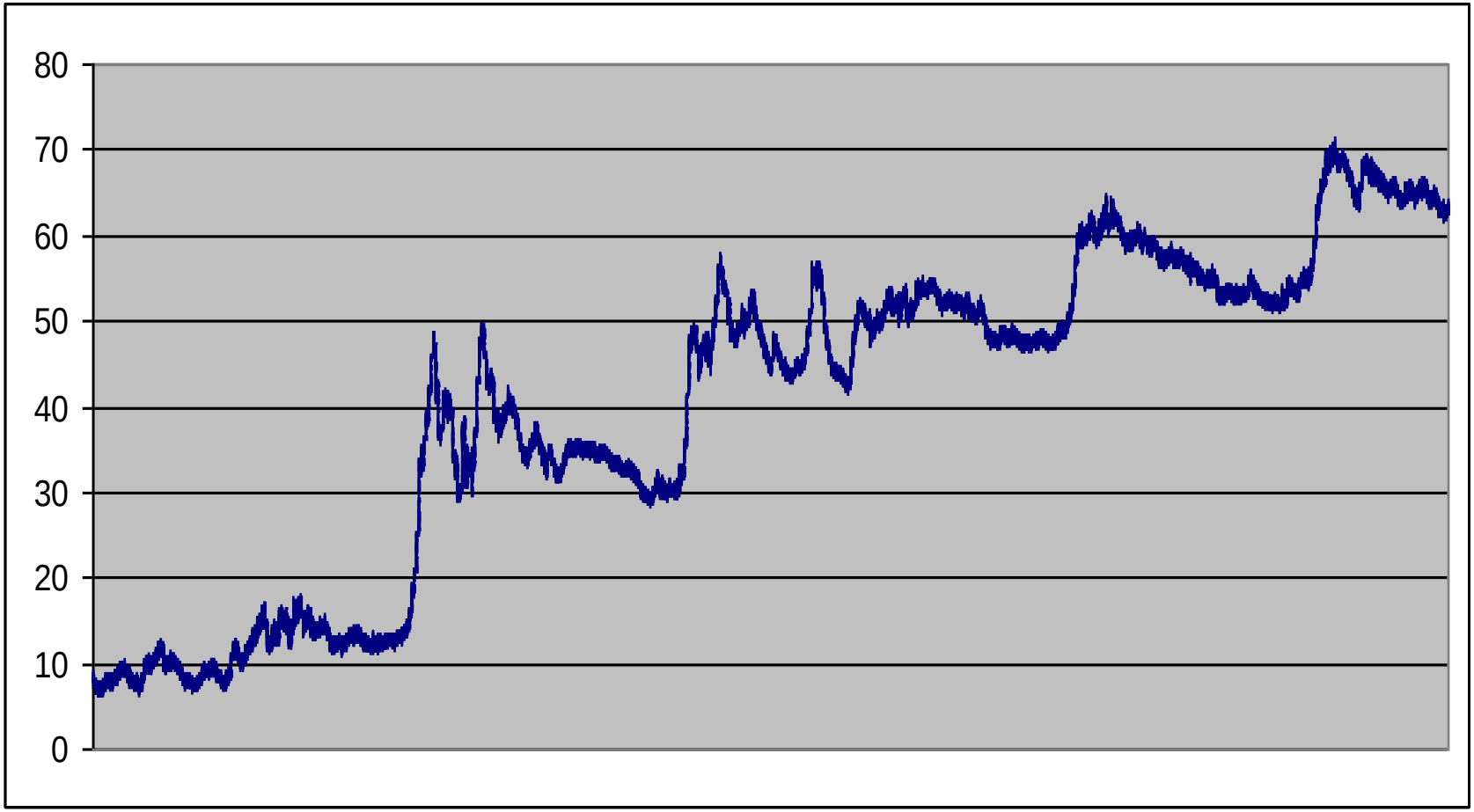
With two layers TF:

1. Pressure was stabilized

2. No major differences in TF pressure at various levels

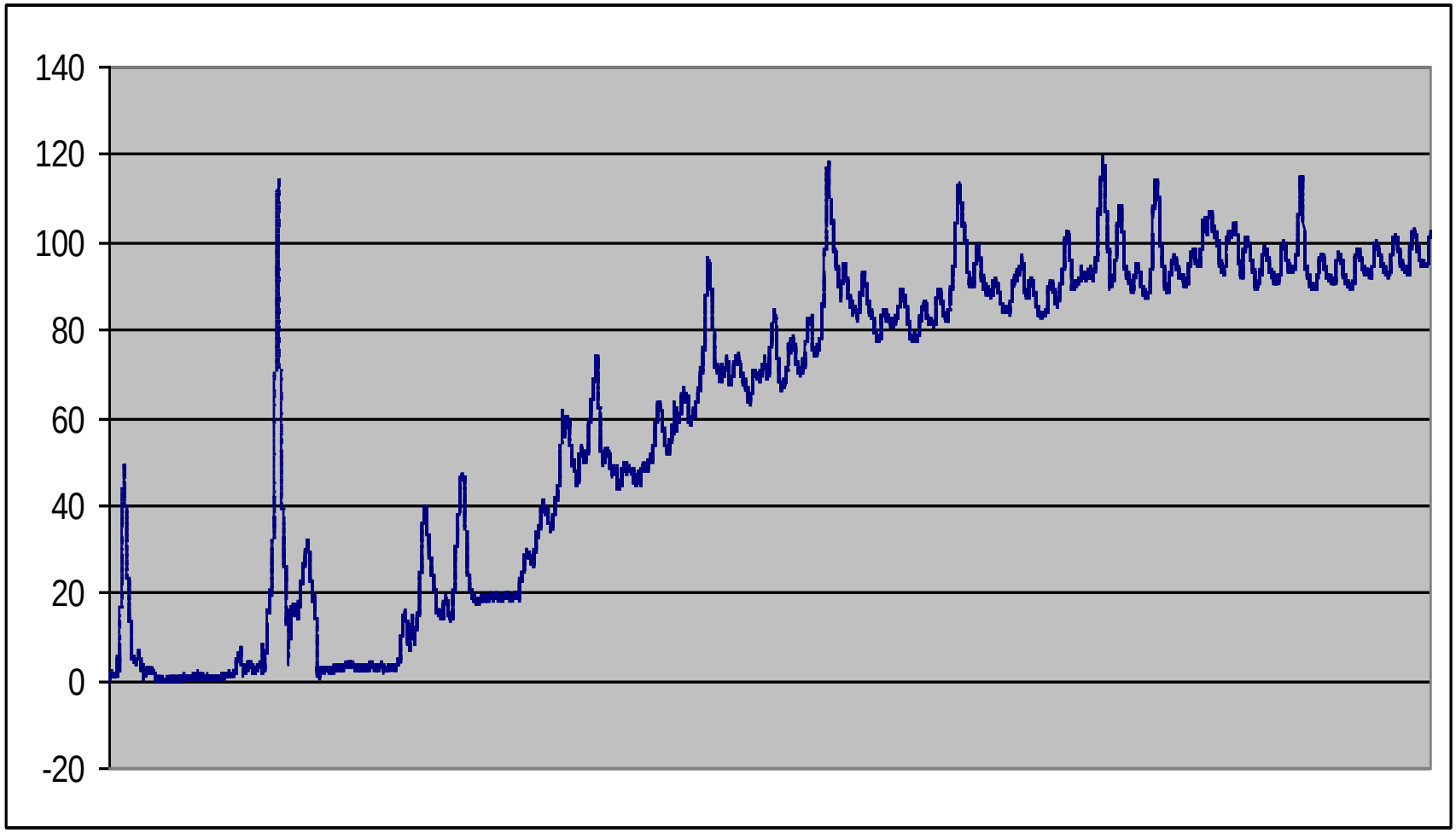
SOLID TISSUE PRESSURE

Bandaging calf level 4,lymphed stage II, mmHg



SOLID TISSUE PRESSURE

Bandaging calf level 4,lymphed stage II, mmHg



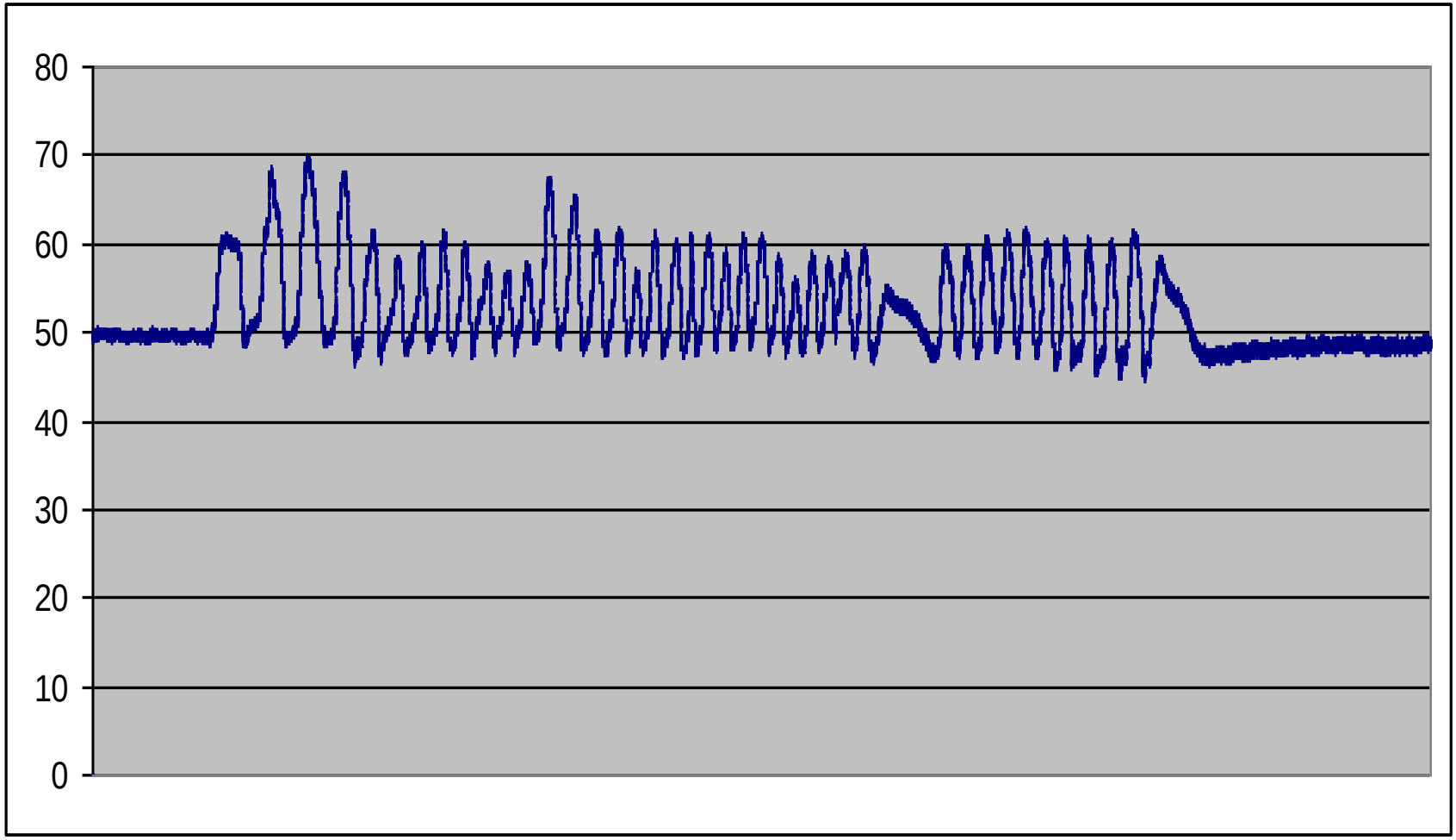
COMMENTS

Solid tissue pressure transmitted from the bandage along the tissue structures was higher than the mobile TF pressure (see TF pressure slides)

SOLID TISSUE PRESSURE

Leg movements under bandage

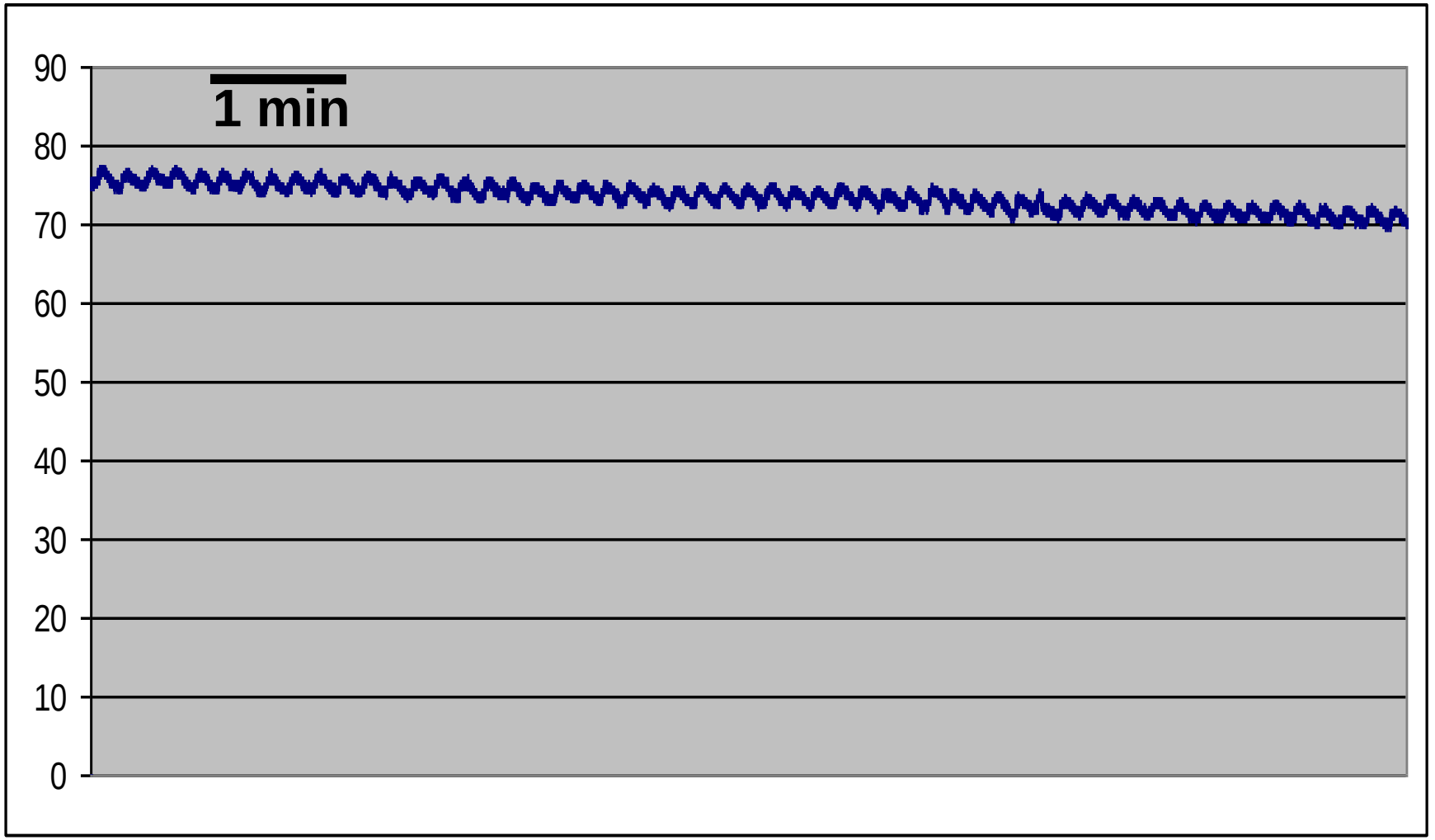
mmHg



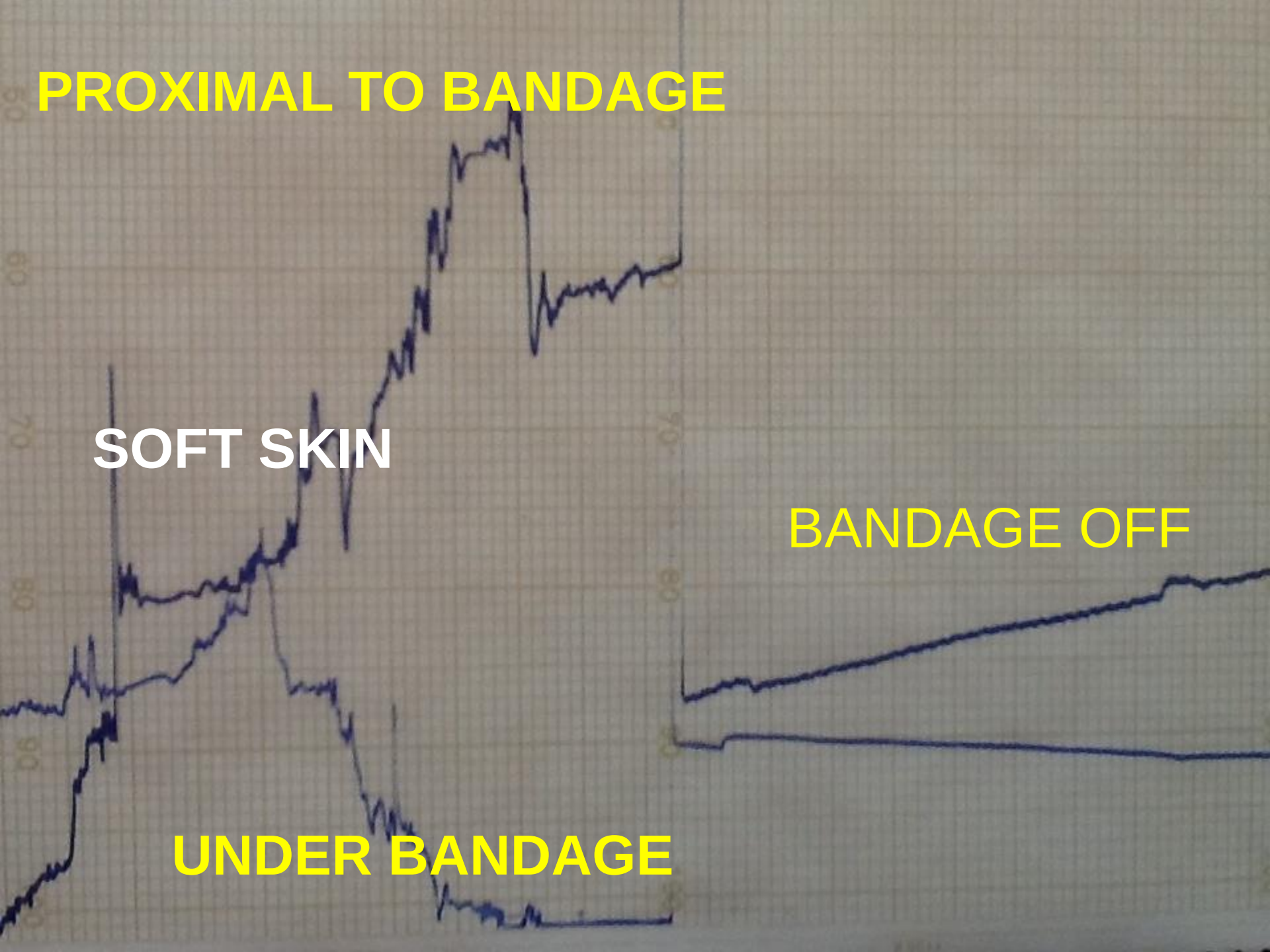
SOLID TISSUE PRESSURE

Bandaging calf level 4,lymphed stage II, mmHg

Pressure drop due to loss of bandage elasticity

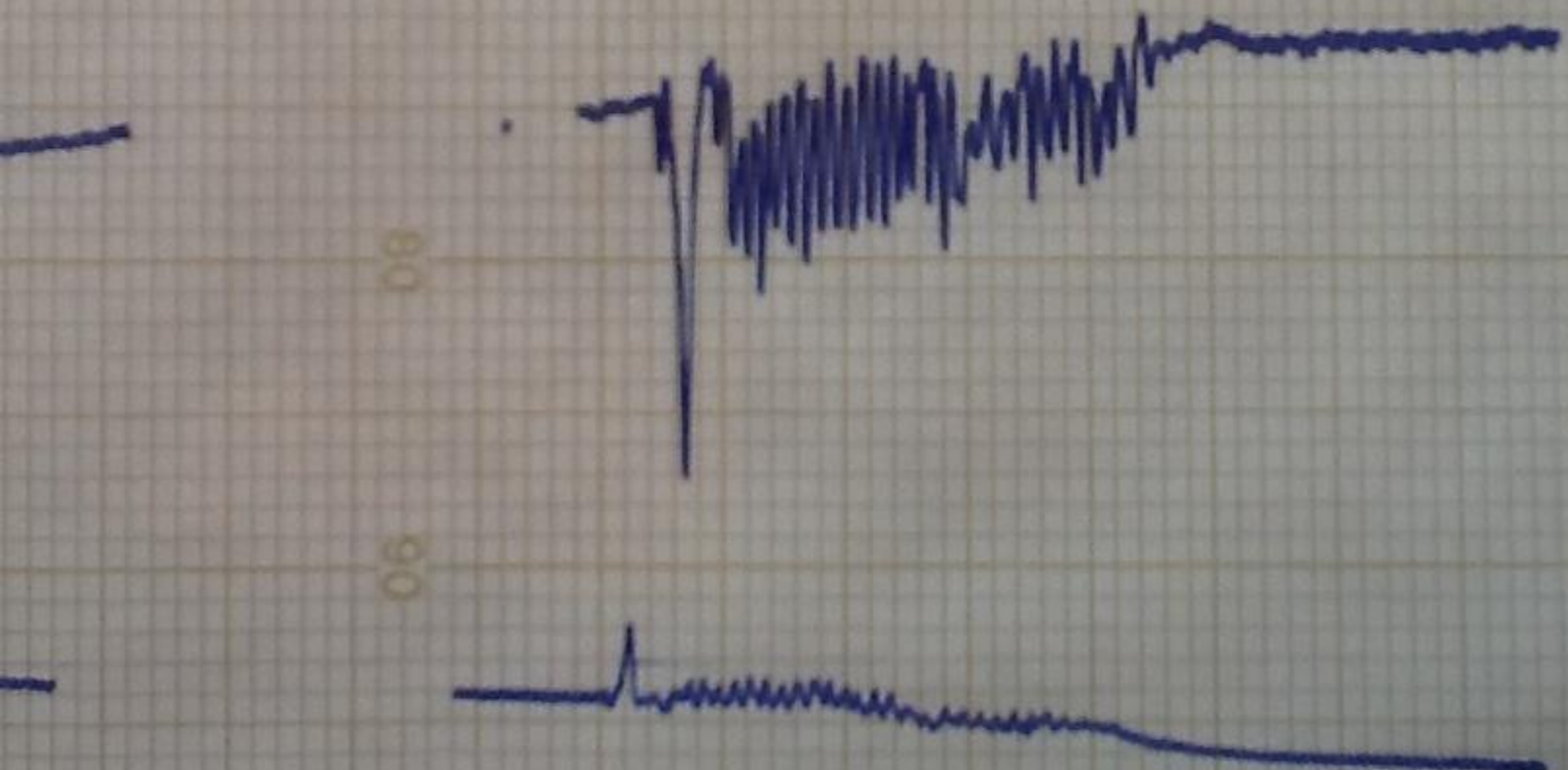


CIRCUMFERENCE CHANGE DURING BANDAGING


PROXIMAL TO BANDAGE
SOFT SKIN
BANDAGE OFF
UNDER BANDAGE

HARD SKIN

PROXIMAL TO BANDAGE



UNDER BANDAGE

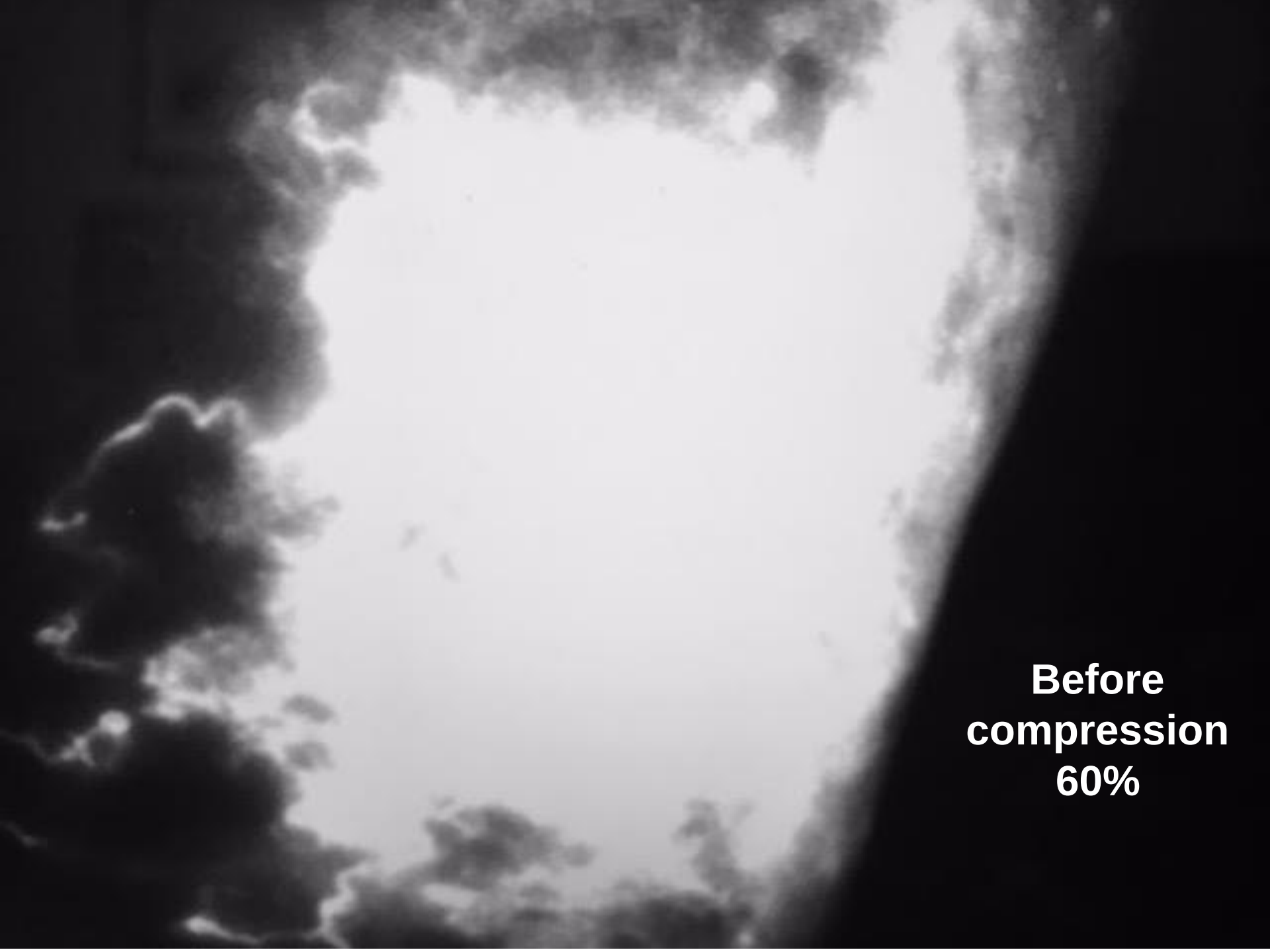
CONCLUSIONS

1.TF pressures generated by bandaging were lower than those at the bandage-soft tissue interface. The difference ranged from 10 to 30 mmHg.

2.Two layer bandaging maintained stable TF pressures

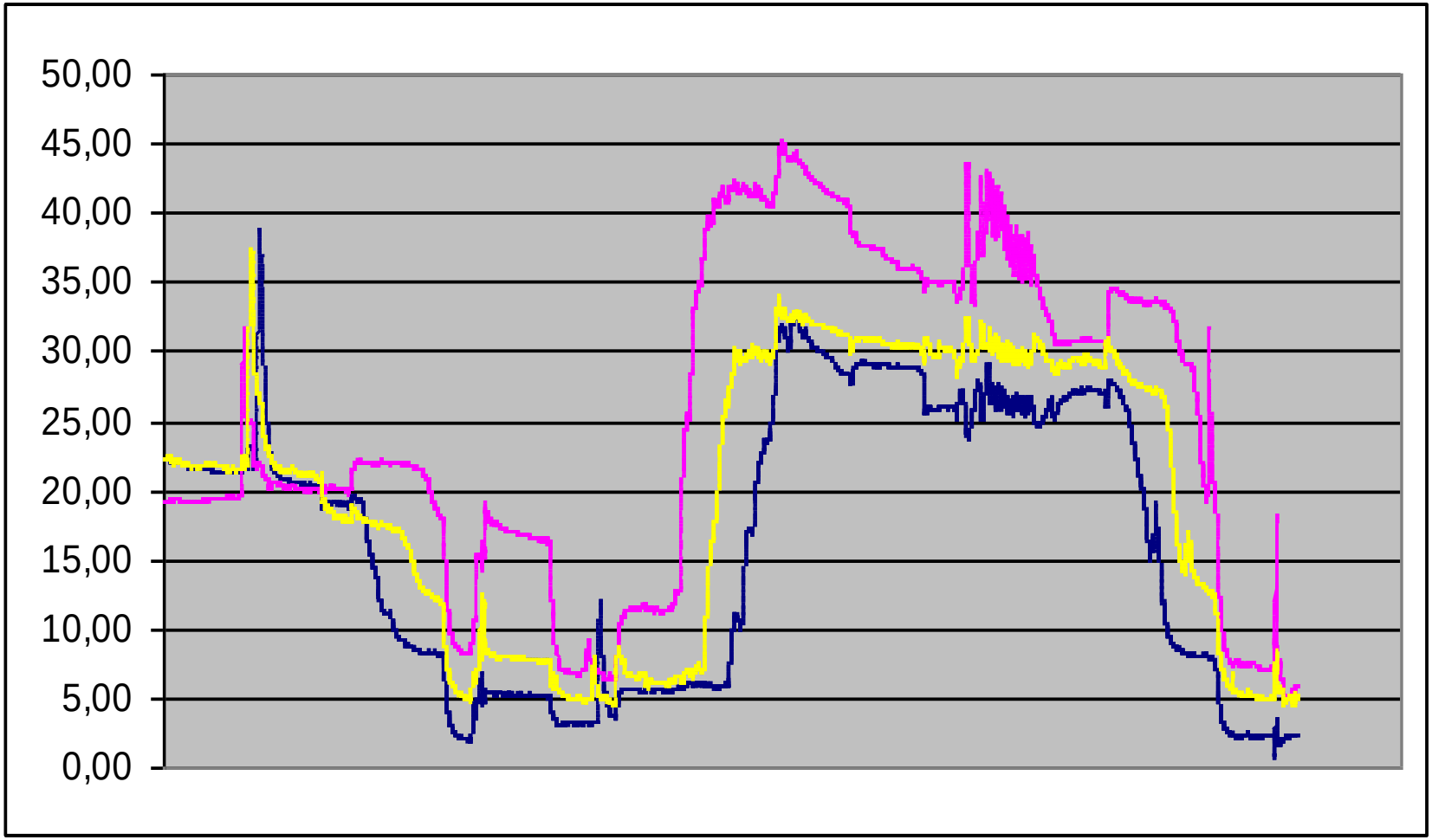
3. There was a continuous drop of TF pressure due to evacuation of TF and loss of bandage elasticity

4. Change in circumference depended on skin elasticity low in limbs with hard skin.

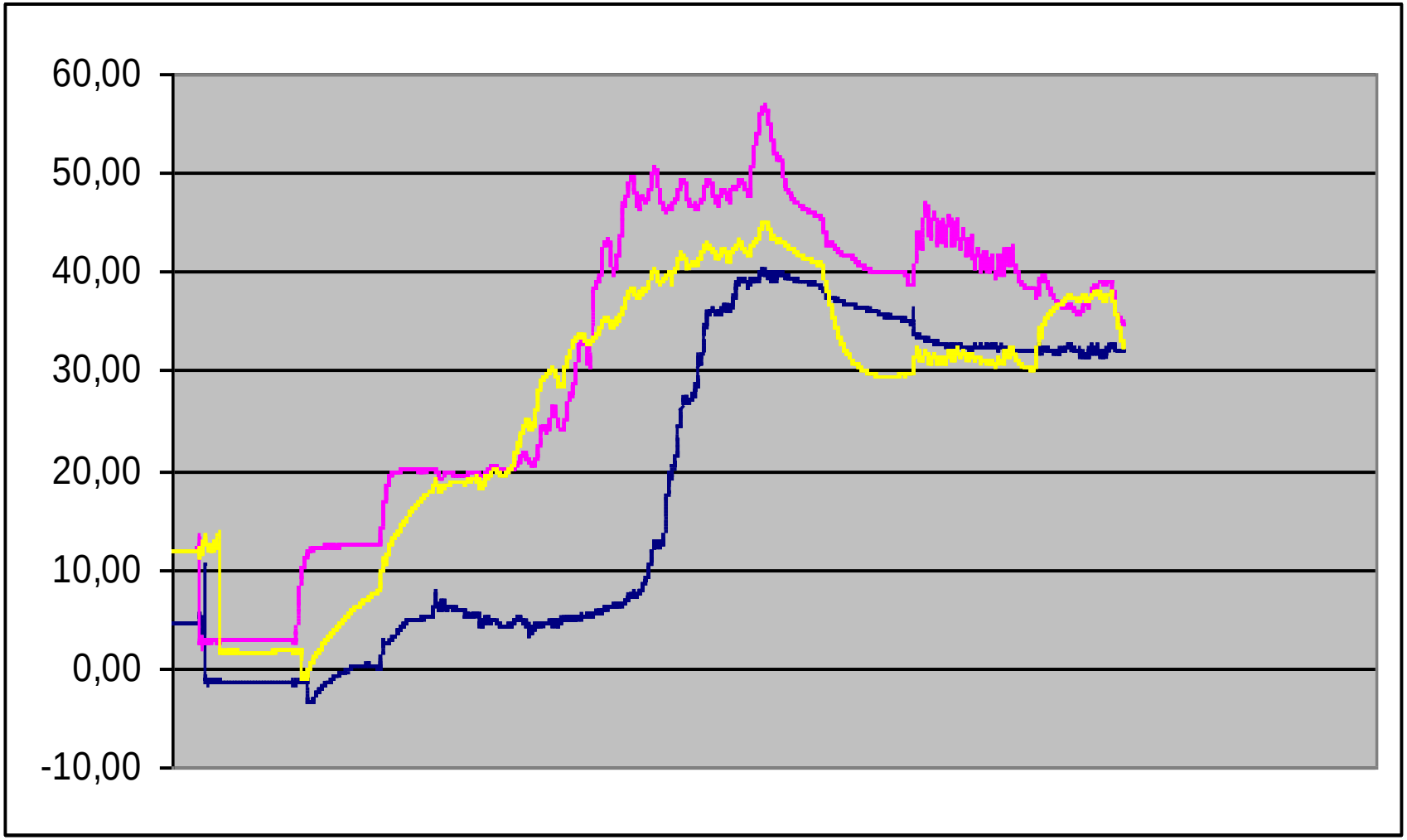

Before
compression
60%


After
Compression
47%

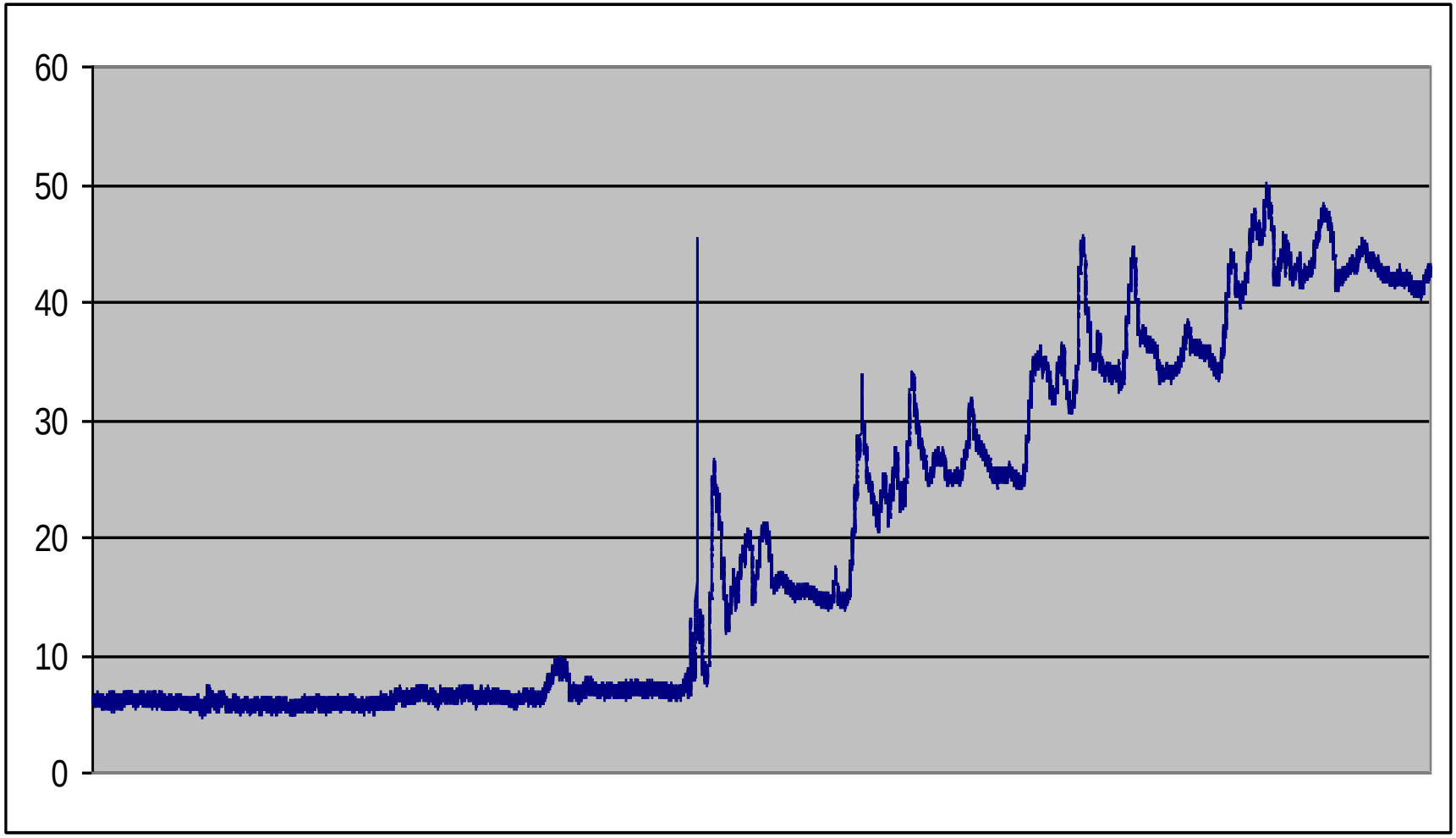
Bandaging, calf, Covan,



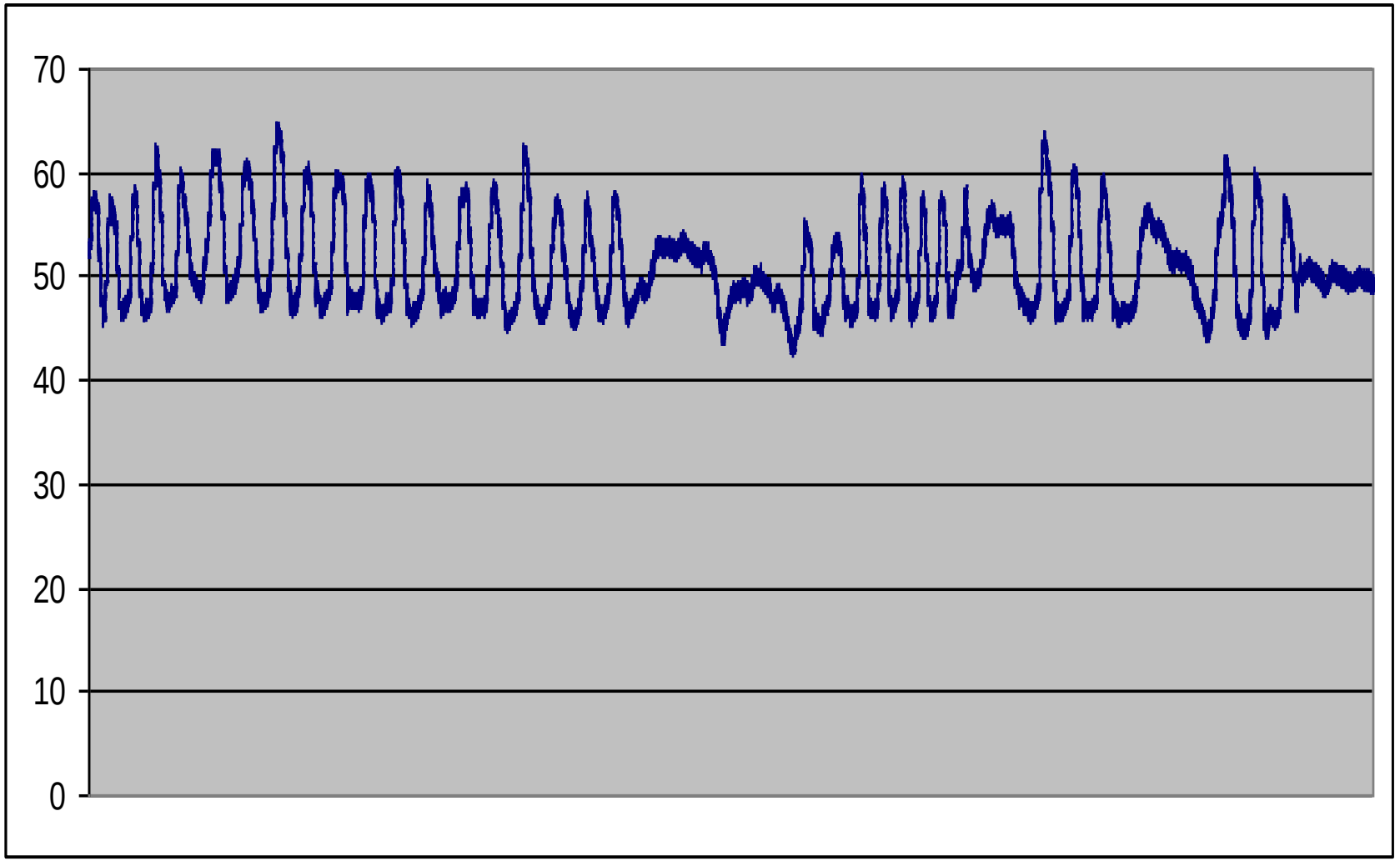
Covan, calf, led IV, 12/7/2011 NDelhi



Varanasi 10.11.2011 led IV calf bandaging tsuahne

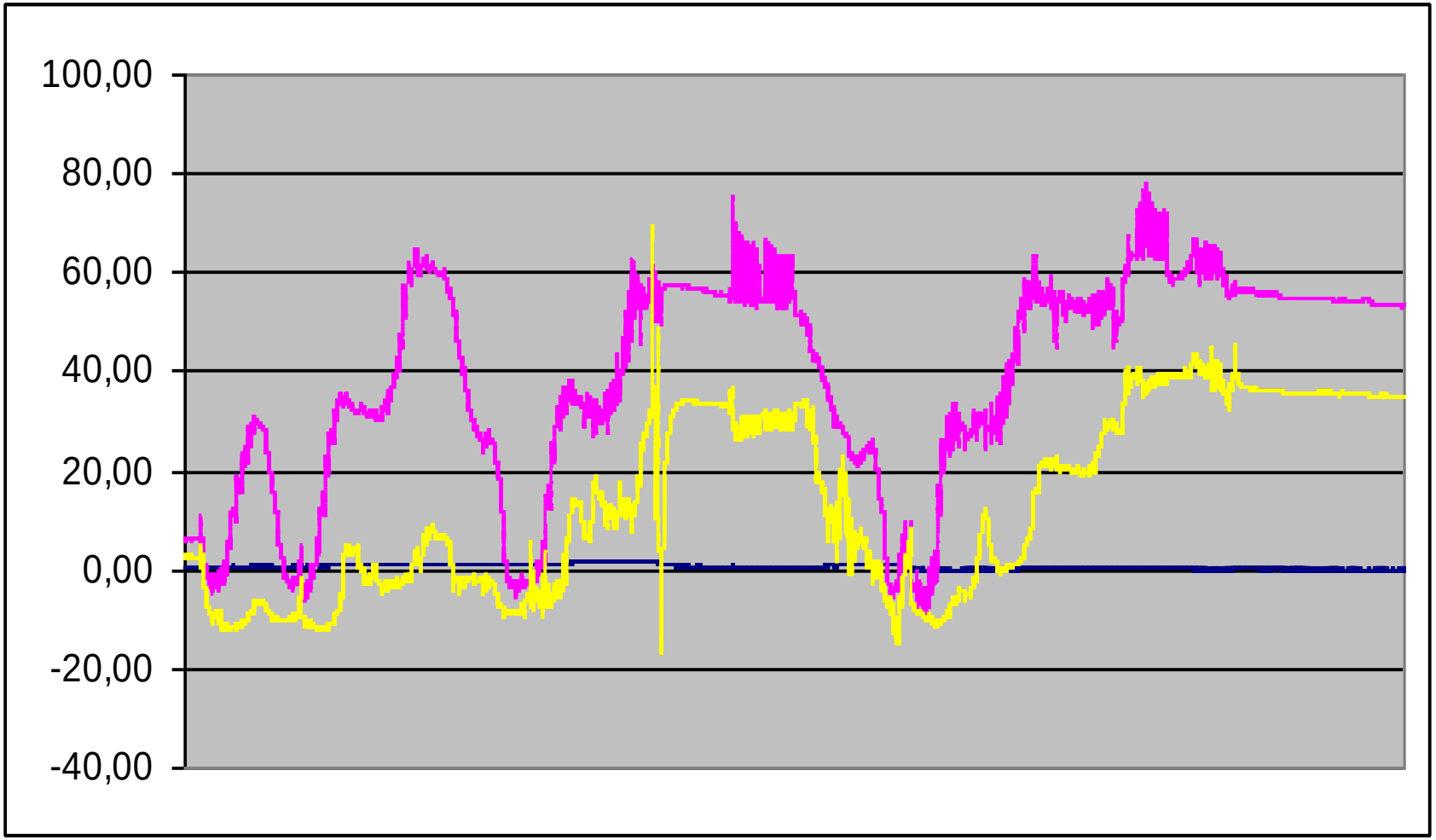


TISSUE FLUID PRESS MID CALF **BANDAGE COBAN**SAMBA LED III N DELHI 11.2011 **movements**

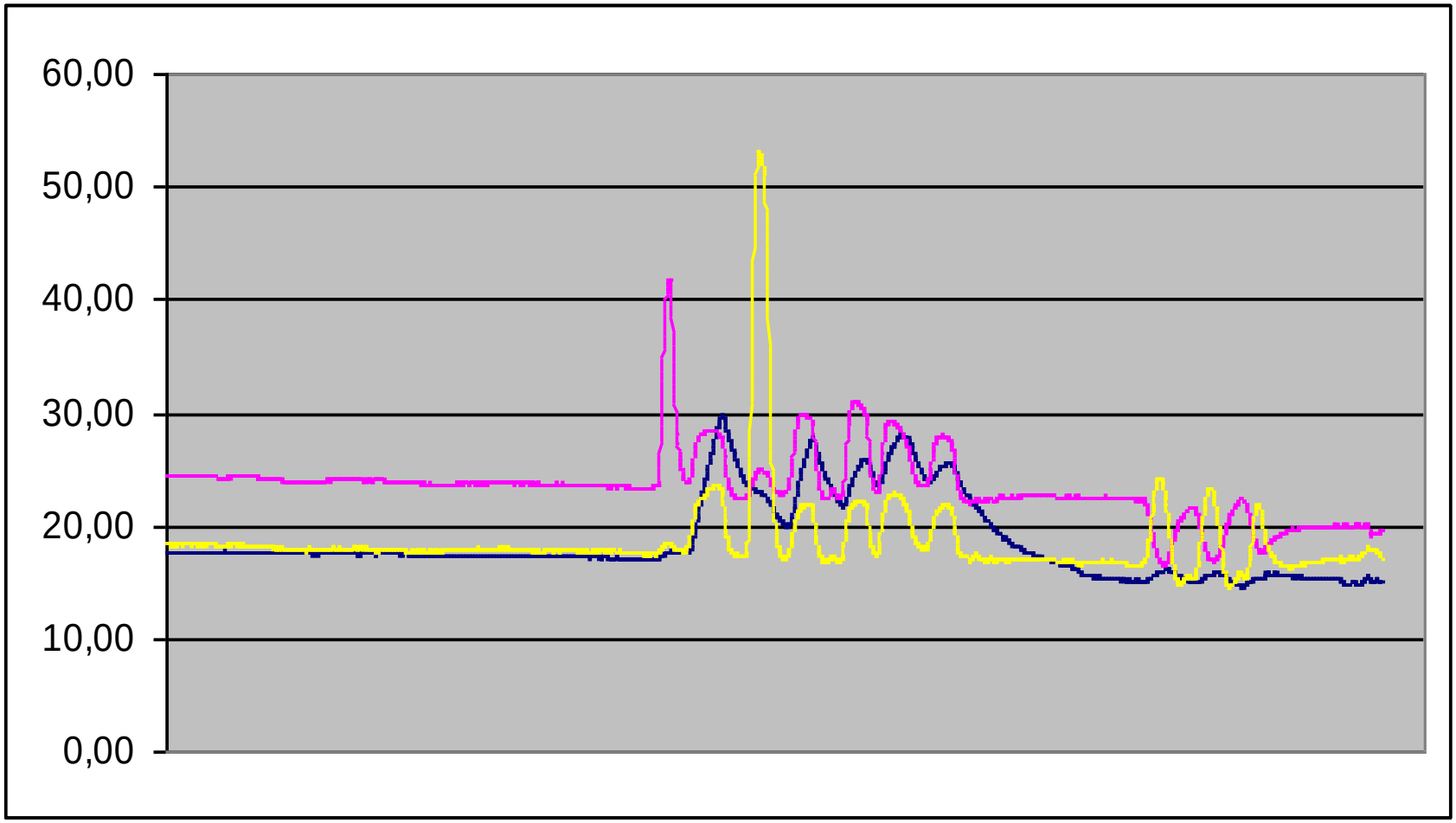


Conclusions. To obtain effective TF pressures generating flow, external pressures by bandaging should be set at the bandage –skin interface of around 60 or more mmHg

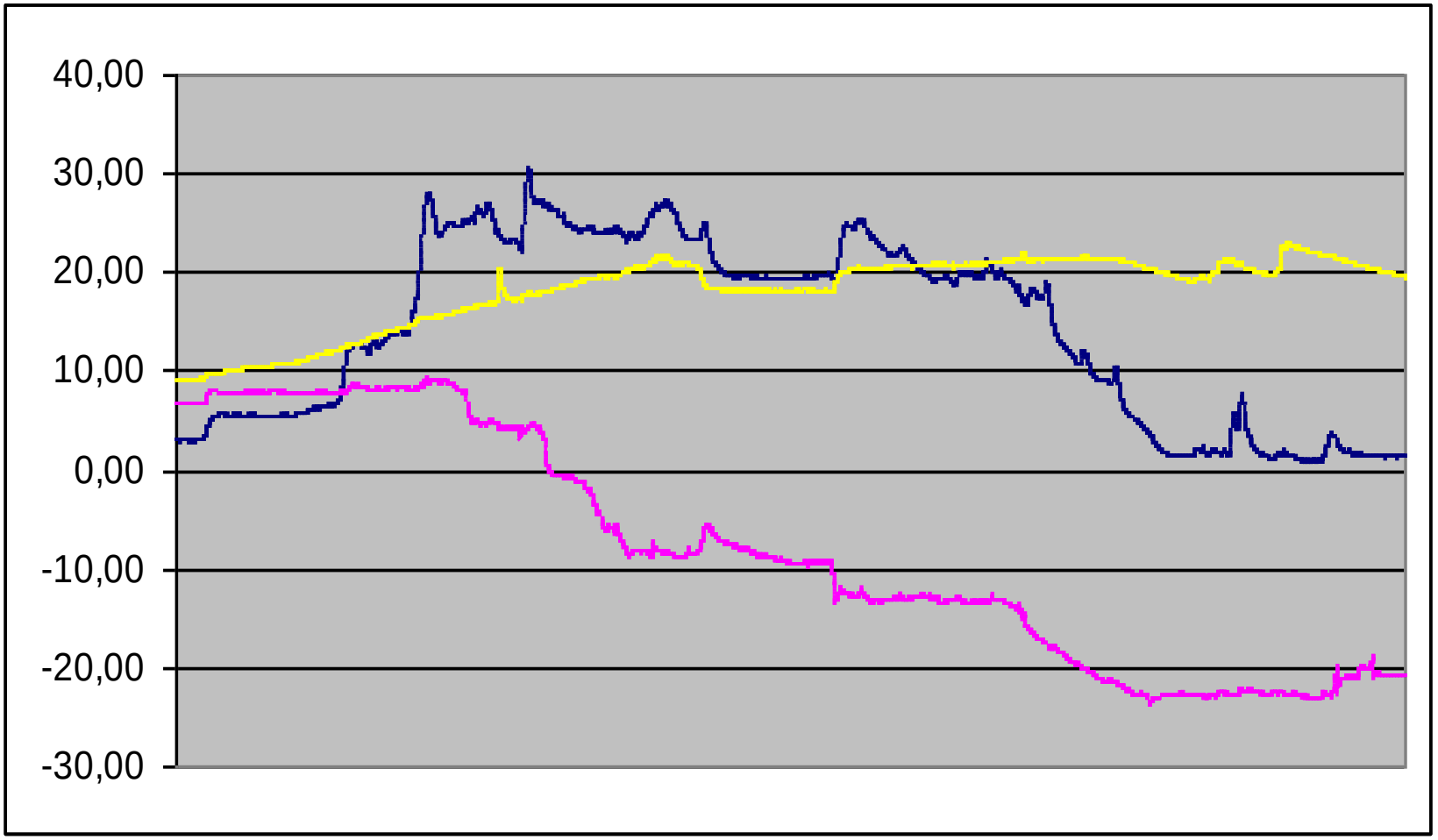
Kow**alska coban midcalf and below knee (yellow) 1 layer 40mmhg second 60,,Hg yellow no pressure after oe layer, to increase with 2 layers. No drop with coban on at rest., horizotal curve, dry tissues? No fluid escape and no pressure drop?**



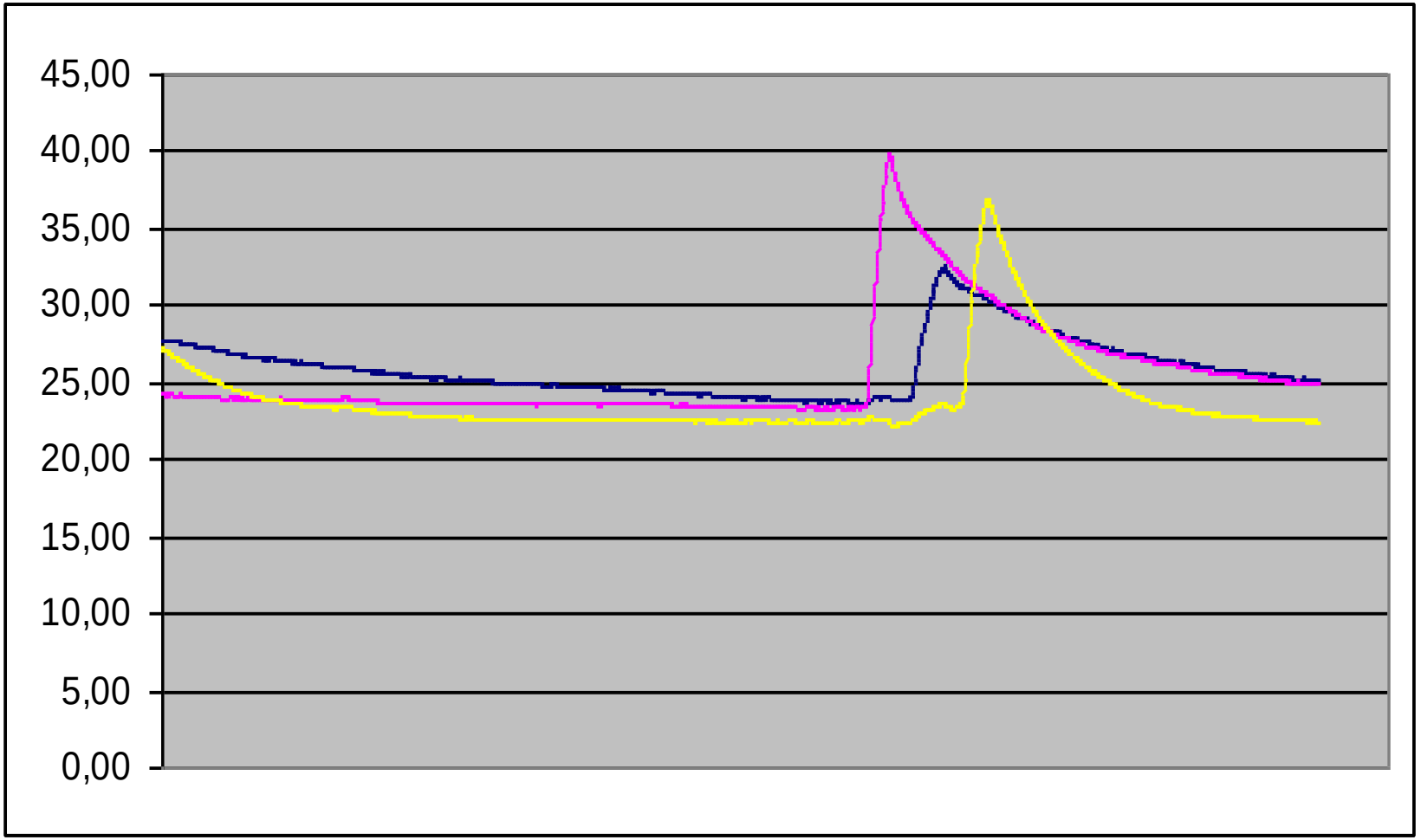
Bandaging, calf, bandage on (coban) , foot movements



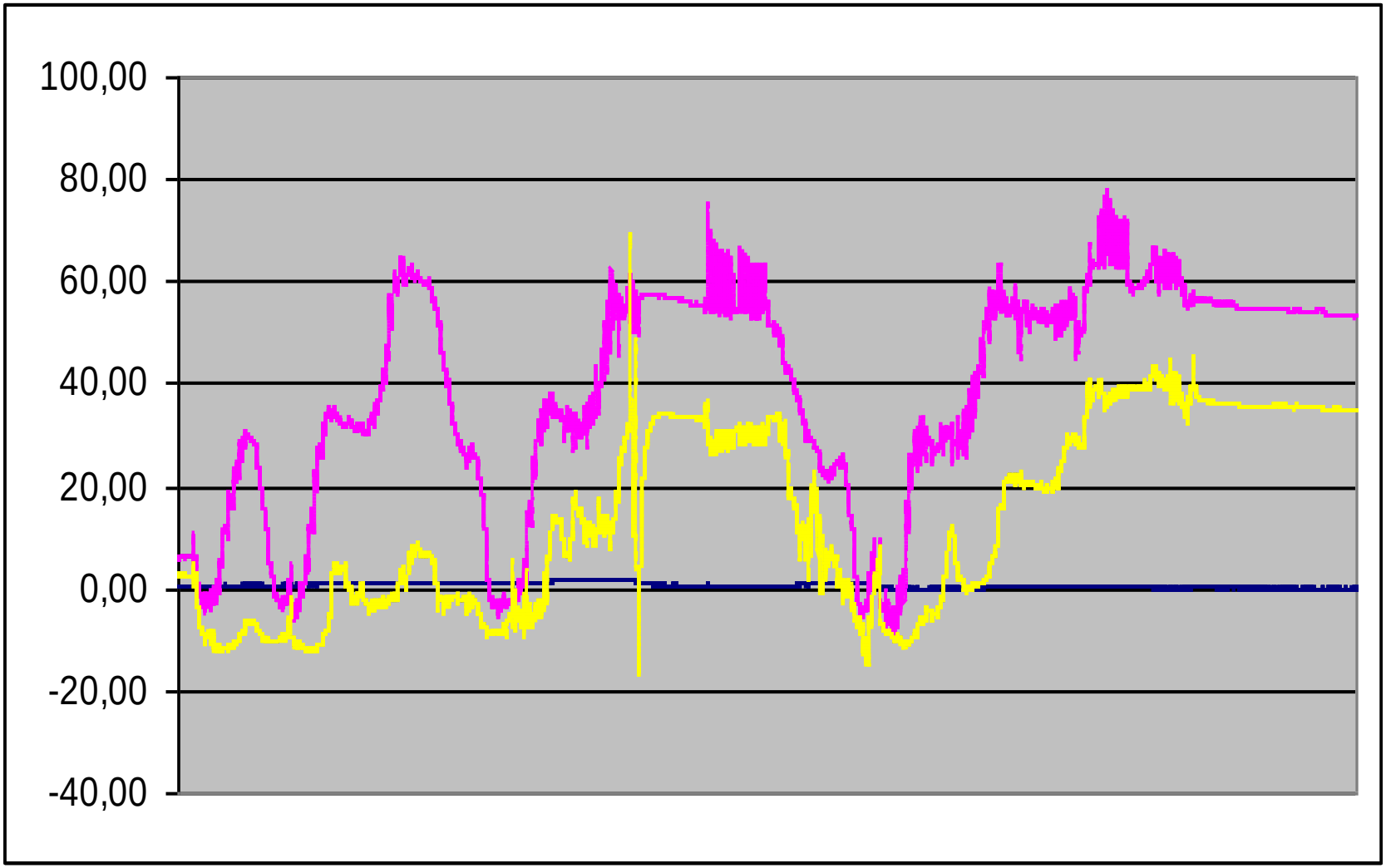
Covan, thigh, led IV, red disconnected, 12/7/2011



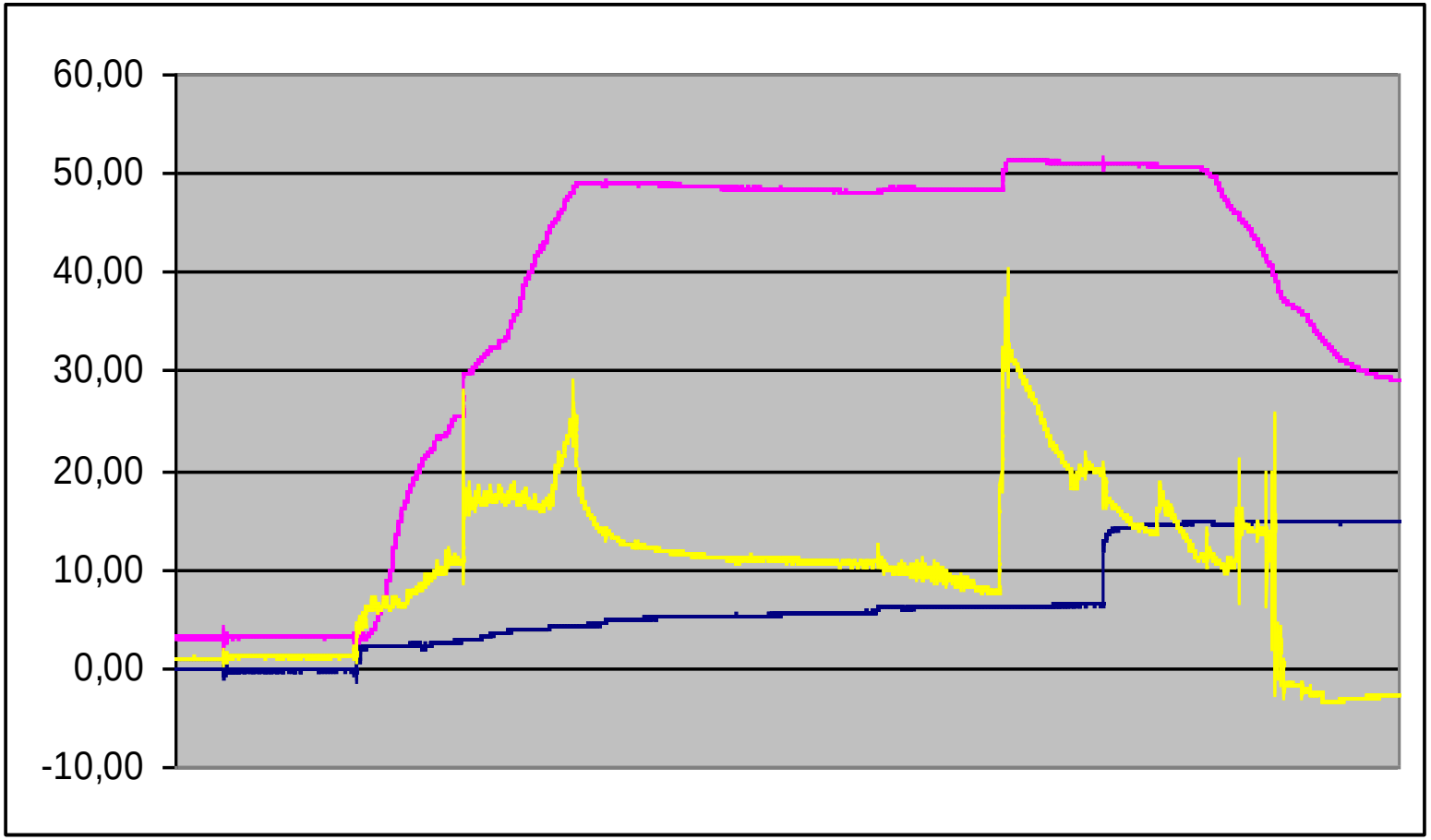
Covan, led IV, calf after bandagng with bandage on, hand pressure return to normal values,after some time of bandaging pressure goes down



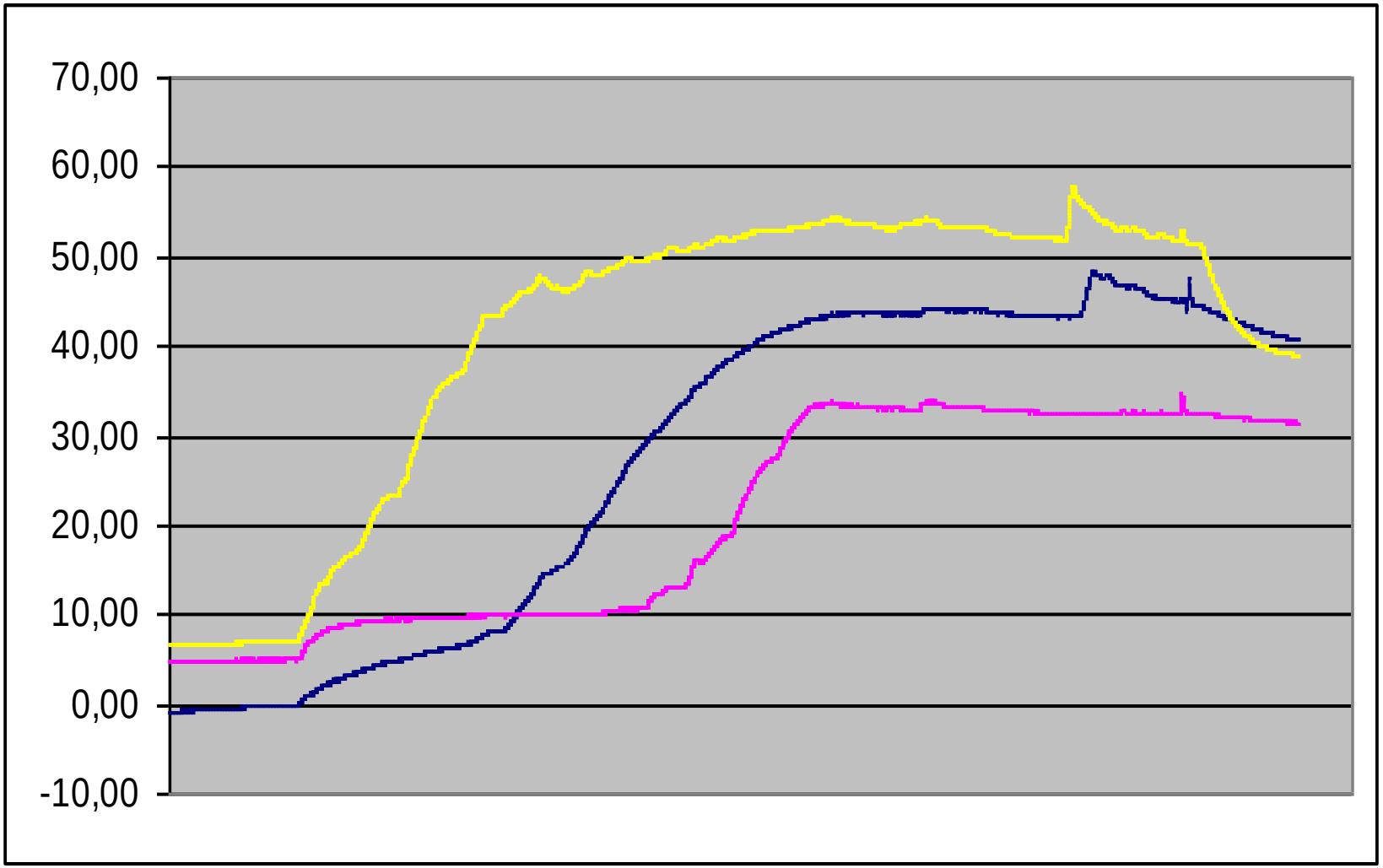
Banadaging Chidambaram March 2012 led IV 3,4,5 level



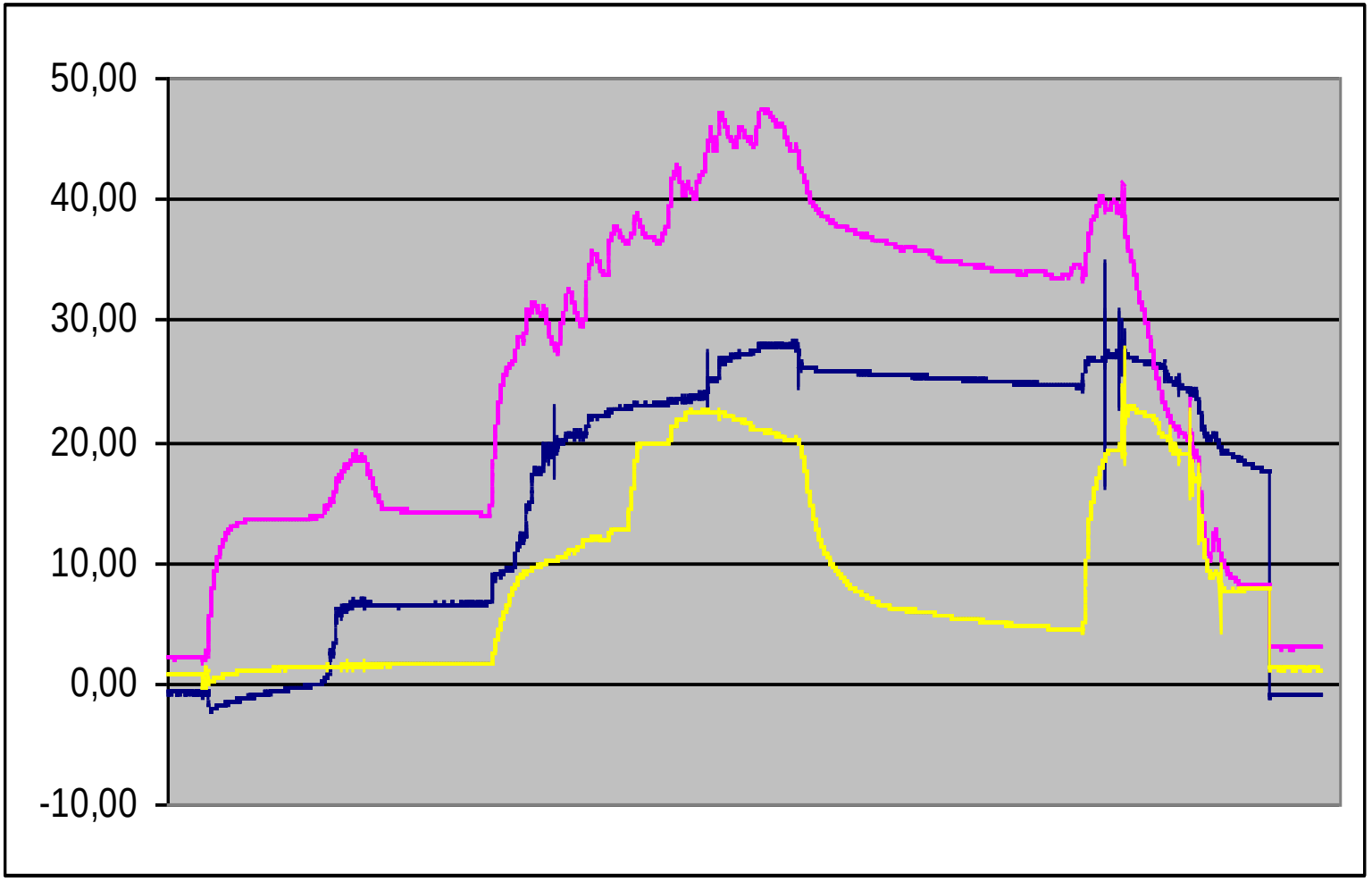
Banadaging Chidambaram March 2012 led IV 3,4,5 level



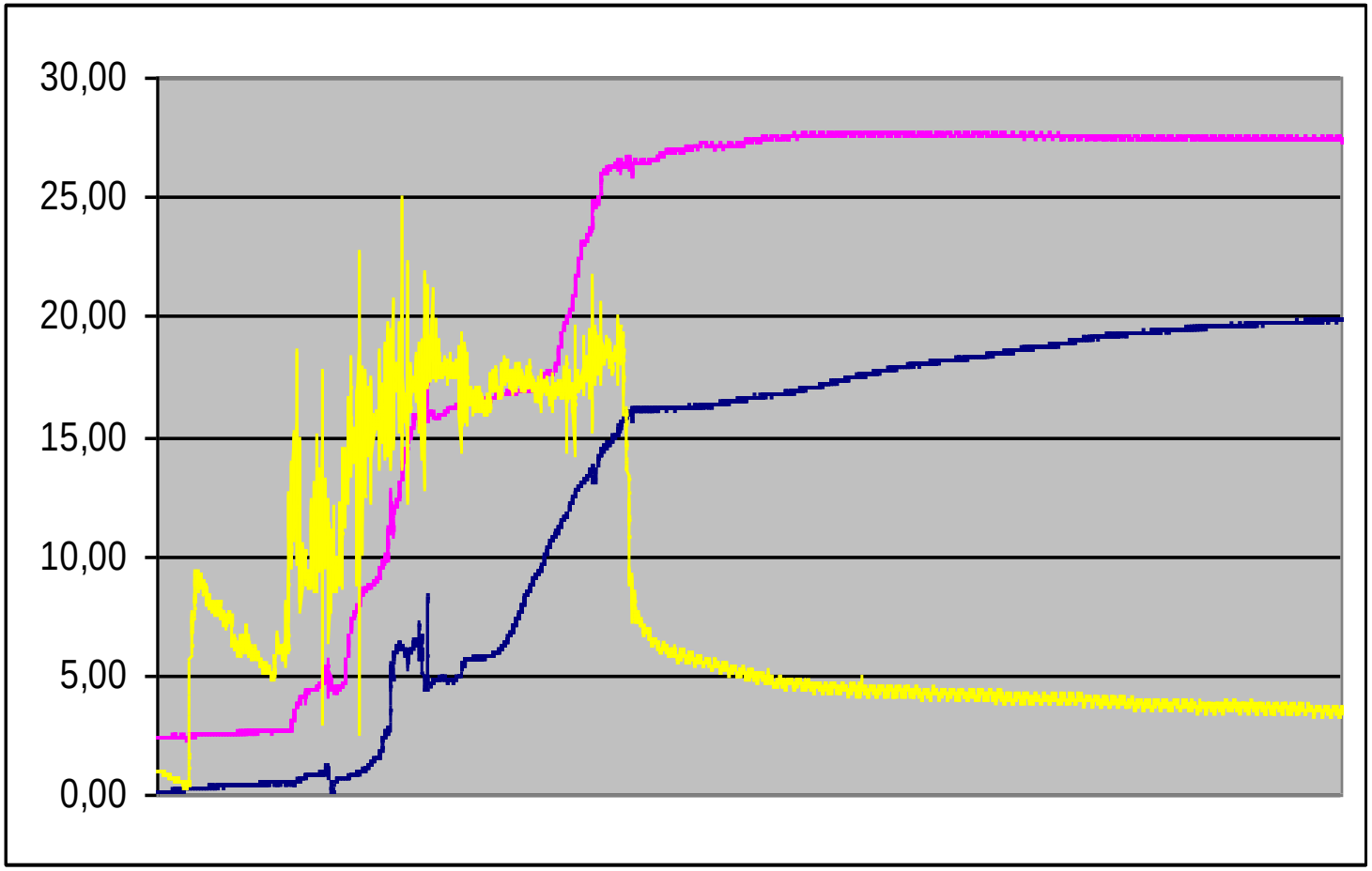
Tuashne, led IV, 12/7/2011 calf



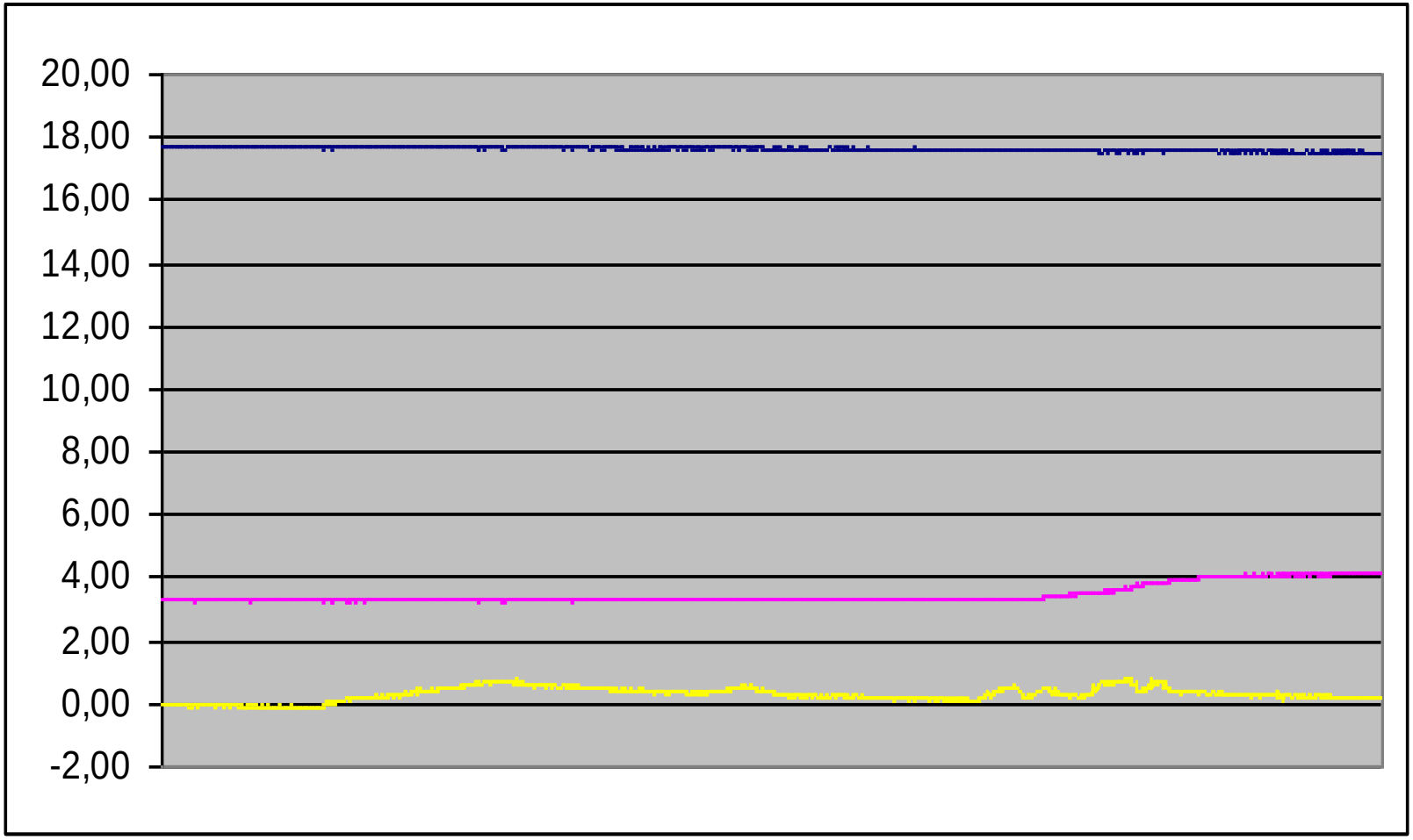
Comprilan, NDelhi, led IV, calf, bandging , movements, resting, bandaging



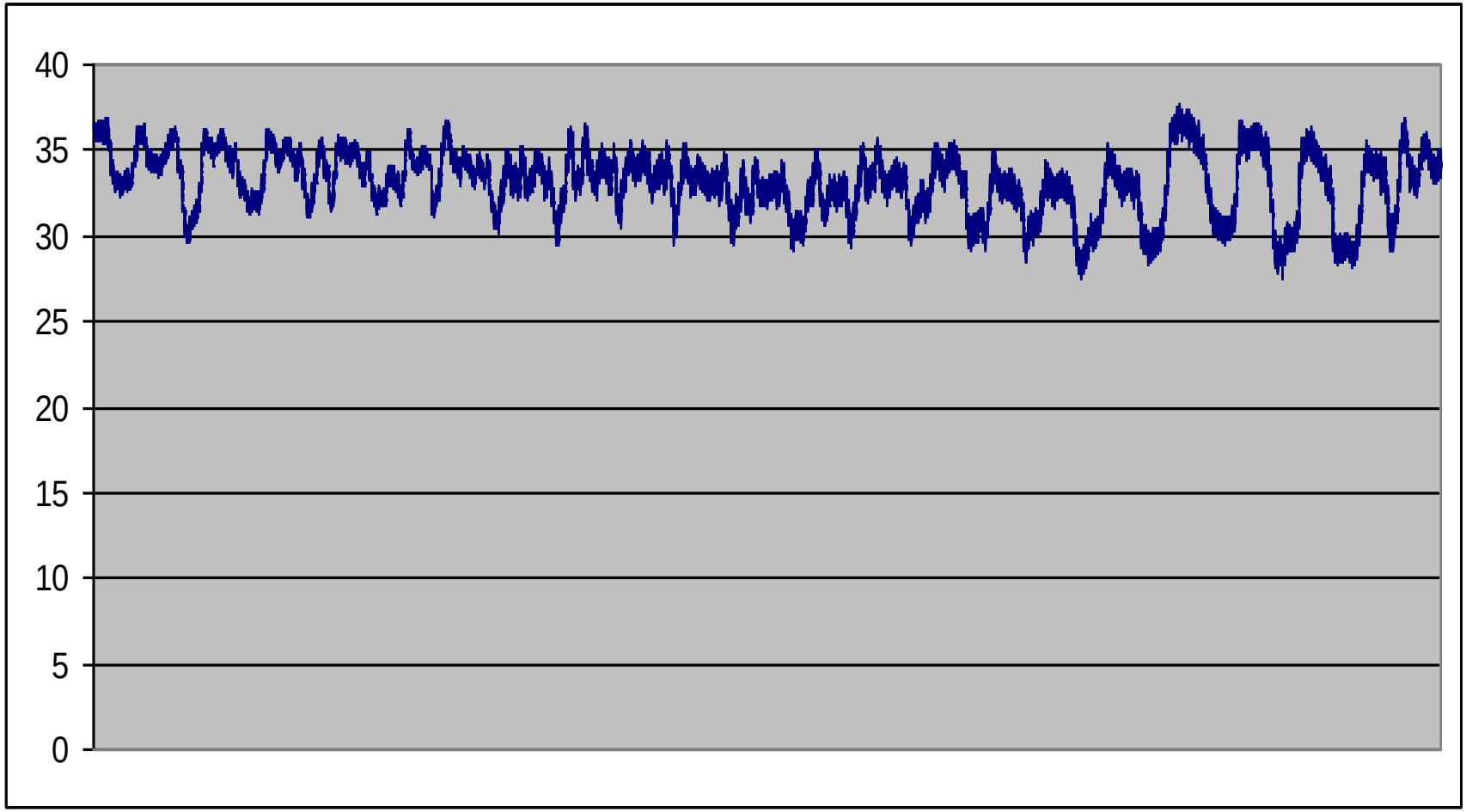
Banadaging Chidambaram March 2012 led IV 3,4,5 6,7,8 level

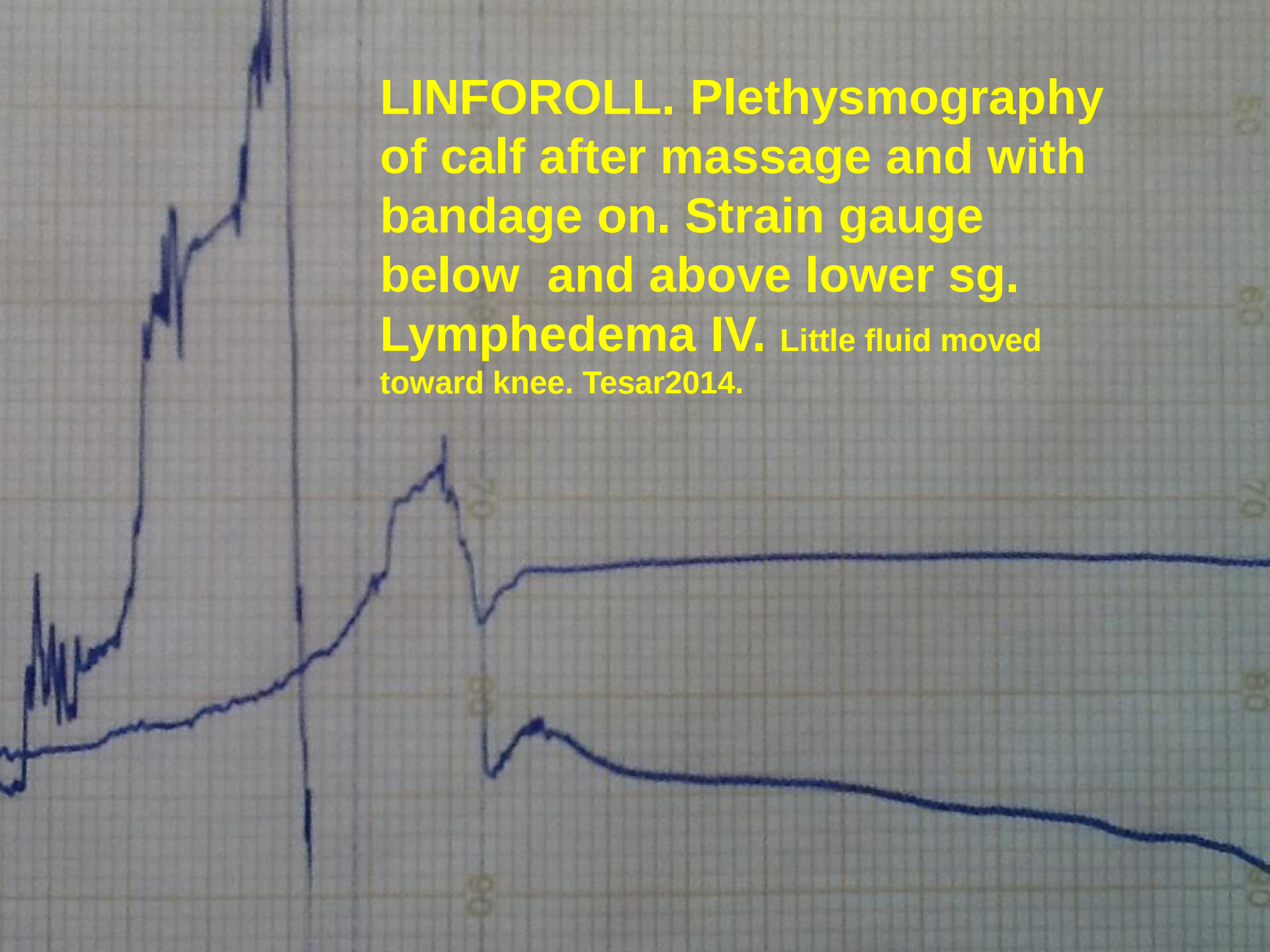


Banadaging Chidambaram March 2012 led IV 6,7,8 thigh level

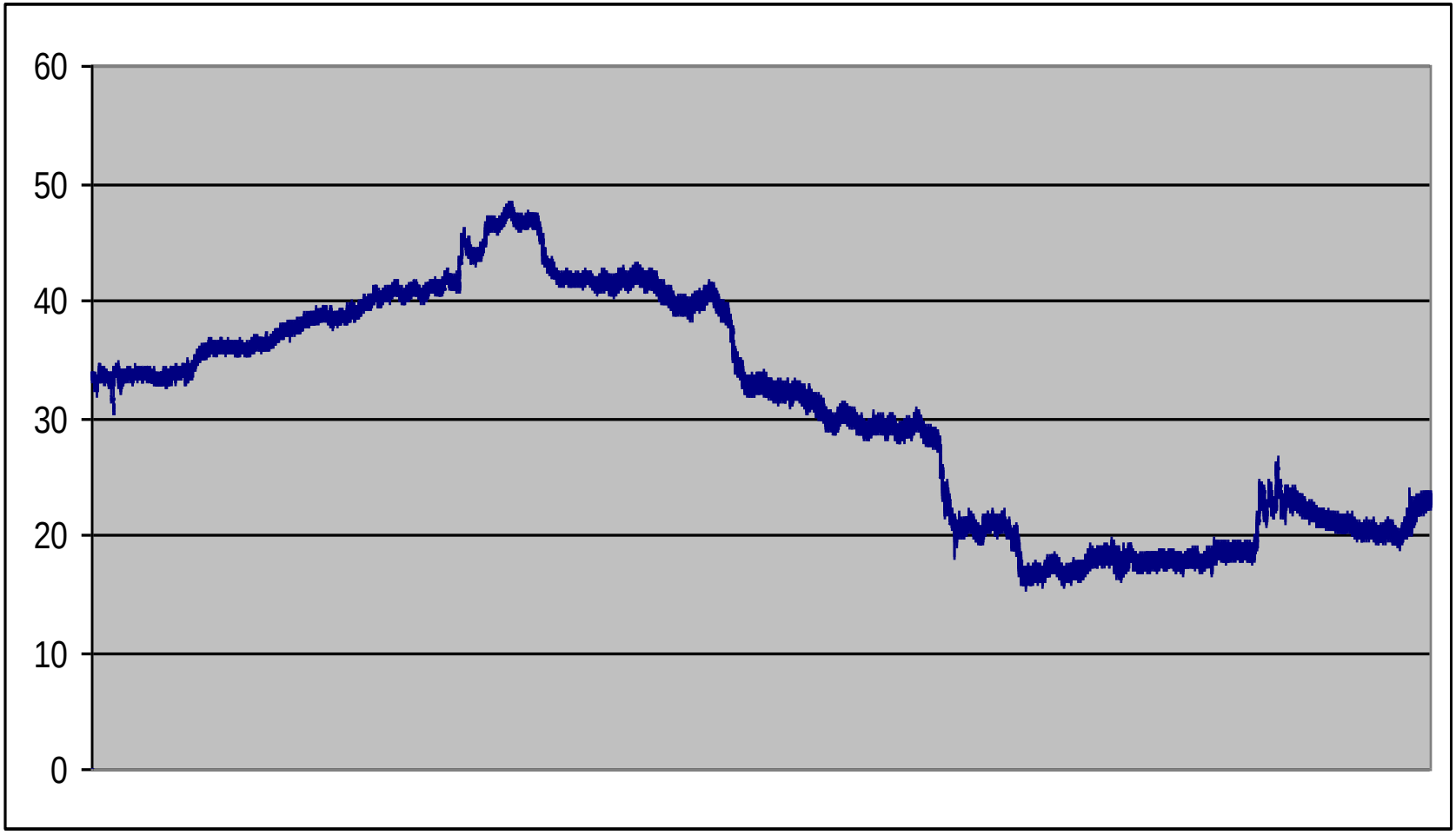


Varanasi 10.11.2011 led IV calf bandaging tsuahne movements




LINFOROLL. Plethysmography of calf after massage and with bandage on. Strain gauge below and above lower sg. Lymphedema IV. Little fluid moved toward knee. Tesar2014.

Bandage removal leg



Kowalska one layer coban mid calf yellow below knee green 30 mmHg no reaction below knee, press drop after emoval of bandage to mmHg down before that because of elvation of limb