

# Study of Trilogy-imaging Characteristics on TTM and its Relationship with Malignancies

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**Abstract:** To study trilogy-imaging characteristics of Thermal Texture Mapping (TTM) and its relationship with malignancies. TTM scanning was performed on 32 normal volunteers and 90 cancer patients who were included in this study. And the trilogy-imaging characteristics were observed. The percent of the characteristics of trilogy imaging on TTM is higher in cancer patients than normal control,  $P=0.0000$ . In normal volunteers who have trilogy characteristics, the percent of the people with cancer family history was obviously higher than those without,  $P=0.0003$ . Trilogy-imaging characteristics on TTM are correlated with the patients with malignancy or the normal people with cancer family history. Neuro-Endocrine-Immunology thesis might be the underlying mechanism of that phenomenon.

**Keywords:** Trilogy-imaging, Thermal Texture Mapping, TTM, malignancies detection, thermal imaging, thermography, immune theory.

## I. INTRODUCTION

Human body is a heat radiant resource in normal condition with balanced metabolism, and the heat is transmitted from the internal to the outside. Once special disease occurs in one site, such as tumor, inflammation, or hyperfunctionism and hypofunctionism, the normal metabolism of regional cells in this site will change, presented by the changing of heat radiance value. Thermal Texture Maps (TTM) can receive ultra-red radiance signal transmitted from cells during metabolism, and examine the exact intensity of different sites. The depth of abnormal heat foci can also be localized, due to its technique of combining with the computer tomography analysis, which is helpful to the exact apposition of the disease. TTM has become the routine examination for screening the breast cancer in some large centers of United States, and has been used in the cancer diagnosis, function examination of certain organ and follow up of drug treatment in China. Patent authorization of US has been permitted in 2000.

In the practice of TTM, we found that independent heat foci can be discovered in head (equivalent to occipital tuberosity), neck (equivalent to thyroid gland) and upper abdomen (equivalent to pancreas) in most of the patients with malignancies (these abnormal heat foci are not obvious in senile and advanced malignancy patients). This phenomenon also exists in a small set of the normal

population, and surprisingly, in this small set, 60% of the people have family history of malignancy in direct relatives.

Great interest has been raised in the correlation of the abnormal heat foci (trilogy-imaging on TTM) and tumor. In our research, we examined 90 cancer patients and 32 normal controls with TTM. Their imaging characteristics were compared to elucidate the relationship between cancer patients and trilogy-imaging characteristics on TTM. From this, we can explore the mechanism of trilogy-imaging characteristics on TTM in cancer patients, and provide theoretic basis for further diagnosis.

## II. METHODOLOGY

### 1) Clinical Materials

90 cancer patients, aged 35~75 (mean 46), entered this study. Among them, 28 were digestive tract cancers, 43 were breast cancer, 17 were lung cancer, and 2 were prostate cancer. They all came from Rui-Jin hospital or Rui-Mei health center.

32 healthy volunteers coming from Rui-Mei health center, aged 25-51 (mean 35), were chosen as control.

### 2) Method

All the patients taking off underwear was resting in the room of examination with temperature of 22-25℃ for heat balance. And Thermal Texture Maps (TSI-2 type system, made in China) was used to take image in standard position. Appropriate variables such as temperature scale, lens and temperature window was set. And topographic analysis was performed according to the saved image after fixation and saving of the clear image on the screen.

### 3) Statistical Analysis

CES2000 software was used for statistics, and  $p < 0.001$  was considered as the significant border.

## III. RESULTS

1) In 90 cancer patients, 86 have trilogy-imaging characteristics on TTM. 2 patients with advanced cancer and

2 senile cancer patients didn't have that characteristic. TTM (+) was set for the patients with trilogly imaging on TTM. Those patients without trilogly imaging on TTM was set TTM (-). **And chi-square test was performed:**

	TTM(+)	TTM(-)
Cancer patients	86	4
Normal population	9	23

Chi-square value (Pearson unadjusted) =62.2843, P=0.0000  
 Results: Statistical significance was reached (P=0.0000), and H0 was refused if  $\alpha=0.0500$  is supposed. The percent of the characteristics of trilogly imaging on TTM is higher in the cancer patients than normal population.

2) In 32 normal control, 9 volunteers had trilogly characteristic on TTM, among them, 6 (more than 66%) had cancer family history in direct relatives. **And chi-square test was performed:**

	TTM(+)	TTM(-)
With cancer family history	6	3
Without cancer family history	3	20

Two supposition are made.

Ho: two groups are equal,  $\pi_1=\pi_2$ ,  
 H1: two groups are different,  $\pi_1\neq\pi_2$ .  
 $\alpha=0.0500$ (both sides)

Exact Fisher P test  
 P (left side) =0.99999258  
 P (right side) =0.00033214  
 P (both sides) =0.00033214

Results : Statistical significance was reached ( P=0.0003), and H0 was refused if  $\alpha=0.0500$  is supposed. The percent of the characteristics of trilogly imaging on TTM is higher in the people with cancer family history than those without.

#### IV. DISCUSSION

In conclusion, we found that most of the patients with malignancies were related to trilogly-imaging characteristics on TTM (corresponding to occipital tuberosity in head, thyroid gland in neck and pancreas in upper abdomen). Are they representing function abnormality of these specific tissue or organ? Is there any theoretical basis behind the abnormal behavior? Based on their correspondent anatomic sites, we think it is associated with hypothalamus, thyroid gland and pancreas. Due to their origin from neuro-endocrine system, we try to discuss the characteristics of trilogly-imaging on the basis of Neuro-Endocrine-Immune theory.

In 1977, Besedovsky first advised Neuro-Endocrine-Immune network hypothesis. In recent 2 decades, a lot of studies were performed on in vivo, cellular and molecular level; the

results have proved the effect of neurotransmitters and hormone molecules on the modulation of immune system. On the other hand, immune cell can produce neuro-endocrine hormone through some cytokines, which indicates that the neuro-endocrine and immune system constitutes a complex network, and the latter plays an important role in the regulation of normal activity of the whole body. However, can this theory explain the phenomenon of abnormal heat foci on TTM in the patients with malignancies?

Studies prove that, in the status of malignancies, there are two kinds of anti-tumor immune response, including specific and non-specific, and many cytokines are involved in this process. At the same time, circulating cytokines can enter the brain through the third cerebral ventricle, bind the correspondent receptors, and exert it effect on central nervous system (CNS), to stimulate the producing and releasing of neuropeptide, such as dopamine (DA) and epinephrine and other local cytokines. In addition, second messenger such as cAMP, IP3 and DAG can be activated by cytokines and antigens. All above prove that cytokines can work on CNS, and indirectly affect the releasing of specific neuro-hormone (TRH, CRH etc) on pituitary gland, and finally regulate the endocrine system, manifested by the abnormal heat foci in the occipital tuberosity (hypothalamus), thyroidal gland and pancreas on TTM imaging. And the compromised immune function in the senile and advanced cancer patients can explain the unobvious heat foci in this population.

The exchange of the message in the above mentioned neuro-endocrine-immune network constitutes a regulative circuit: antigens (including tumor antigens) stimulate the releasing of the immune cytokines, and the latter work on the distant neuro-endocrine structure, and then feed back to CNS, and the CNS can regulate the peripheral immune system through the releasing of hormones and peripheral neurotransmitters and neuropeptides. In the animal models, the electronic activities and hormone shifting rate in the neuro-endocrine system changes greatly alter the activation of the immune system by antigen. This result is the strong support of the theory, so we can believe that the imaging of TTM can confirm the modulation of neuro-endocrine-immune network and stress status indirectly.

We have discussed relationship of the abnormal neuro-endocrine-immune system and the trilogly-imaging characteristic on TTM in the patients with malignancies. However, the statistical data show that a lot of the normal volunteers also manifest trilogly characteristics on TTM, and above 60% of these volunteers have direct family history in direct relatives. How can we explain this phenomenon given no clinical malignant parameters is found in these patients? Study shows that malignancy is a kind of genetic disease, decided by both genetic and environmental factors. The volunteers with family history may carry potential abnormal genes, which determine the evolving of malignant cells, and

the abnormal protein expressed by these genes can induce immune response and further affect neuro-endocrine system. Due to the long process of the forming and developing of the tumor, the neuro-endocrine-immune network was already in stress status, and form the characteristic change of TTM imaging. Theoretically, specific anti-tumor immune response works in the early or even primitive period of the tumor, so we can discover of the occipital tuberosity, cervical and mid-or para-abdominal abnormal heat foci in the very early stage of the tumor, which will help us in the early diagnosis of the tumor if the results are proved by prospective studies.

## V. CONCLUSION

Different from routine biochemical essays and imaging examinations, TTM is convenient, non-traumatic and economical. At the same time, it can provide additional information of the status of immune function, besides exact tumor image. The tumor platform of TTM is especially helpful to the patients with occulting history or susceptible to malignancy, and indicated for the health examination and disease screening. Further study will be performed to evaluate its efficacy, due to our insufficient experience of this technique and limited knowledge in neuro-endocrine system.

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