World Cancer Research Journal WCRJ 2016; 4 (1): e830

EDITORIAL – TISSUE RESONANCE INTERACTION METHOD: A CHALLENGE FOR THE EARLY AND NON-INVASIVE DIAGNOSIS OF SOLID CANCERS

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KEYWORDS: *Tissue resonance interaction method, TRIM probe bioscanner, Cancer screening, Non-invasive imaging.*

Early detection of cancer plays a pivotal role in clinical care. Early cancer diagnosis is primarily made by a wide spectrum of imaging techniques, characterized by high accuracy (i.e. MRI, CT, US, PET/CT, etc.). Elevated sensitivity and specificity of these imaging modalities are the sums of combined use of specific contrast agents, such as ionizing radiations, or they are characterized by invasiveness (i.e. endoscopic exams or biopsies). For these reasons, they cannot be easily used as screening tests, while non-invasive tests like ultrasound, are well tolerated by patients, not expensive, and of side-effects-free. However, an early and efficacy screening by ultrasound is reliable only for a limited number of accessible organs/districts.

In the last years, a novel diagnostic non-invasive tool gained the attention for research and clinical applications: the Tissue Resonance Interaction Method bioscanner (TRIM, Galileo Avionica, Turin, Italy). TRIM is based on an electronic device employing frequency-selective (resonant) absorption of electromagnetic waves capable of detecting biological abnormalities of human tissues *in vivo*.

In particular, cancer tissue is connected with a mitochondrial malfunction that induces a lowered ordering level of cellular water and increases damping of microtubule-based cellular elasto-electrical vibration states[1].

TRIM uses a non-linear radiofrequency oscillator probe emitting electromagnetic waves at different frequencies: 462-465, 930, and 1395 Megahertz (MHz), and a receiver which analyses the interactions of the electromagnetic field with the body tissues (Figure 1).

By a dedicated software program, TRIM enables to view such interactions and to record the obtained "spectrum" corresponding at the frequencies above mentioned (Figure 2). Each frequency is specific for a different biological tissue, malignancy, inflammation and benign tumor respectively.

The reduction of amplitude or disappearance of the wave's spectrum is suggestive of tissue alteration. The final result is a "whole body", non-invasive analysis of tissues, enabling to define the presence of different pathological stages[2-4].

Clinical studies have been done in patients with urological or gastrointestinal tumors[5-13].

A first, significant study, was performed on 757 patients, with elevated prostatic specific antigen (PSA) levels and abnormal clinical examination[5]. TRIM showed a sensitivity of 95.4% and a specificity of 42.7%. In three other similar clinical studies[6-8], the method showed a diagnostic accuracy ranging between 60 and 72% or even higher when TRIM was integrated to the digital rectal examination or multiparametric MRI.

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Fig. 1. TRIM bioscanner: the probe and the receiver.

Two other clinical studies[9,10] were conducted in order to detect bladder cancer in large series of, 114 and 125 patients respectively and showed a diagnostic accuracy of 89.5% and 93.6% respectively.

In the diagnosis of rectal cancer, two papers[11,12] showed promising results, compared to endoscopic examination, with a diagnostic accuracy of 90%.

More recently, Dore et al[13] compared, in a double-blind study, colonoscopy and TRIM in 281 patients. TRIM identified cancers and polyps with high sensitivity (98.7%), specificity (96.2%), and a diagnostic accuracy of 97.5%; compared to colonoscopy and histology analyses.

The positive predictive value was 96.7% and the negative predictive value 98.4%. Only 5 false positive results (1.8%) and 2 false negative (0.7%) occurred by TRIM evaluation.

Finally, more than ten years ago, three pilot studies[14-16] on the thyroid, breast, and gastric cancer respectively were conducted, but they were not followed by further assessments.

These preliminary data in the literature suggest that the TRIM may enable very high diagnostic accuracy; especially when it is integrated with commonly used procedures, according to the different organs. For instance, TRIM might be proposed in the screening programs for colonic and rectal cancers. Thus, the combined use of TRIM with other diagnostic methods will significantly increase the diagnostic accuracy, maximizing the advantages of clinical practice.

An aspect which should be carefully addressed in the near future is the management of those patients who have a positive scan by TRIM with no evidence of disease by the common imaging modalities. Thus, both in the screening phase or the evaluation of a possible neoplastic recurrence during the follow-up, the lack of concordant imaging results may induce conflict for the surgeons/oncologists in the management of the patients. Therefore, it is essential that the TRIM experience will be conducted by expert hands, in dedicated Centers with a cautious interpretation of the results.

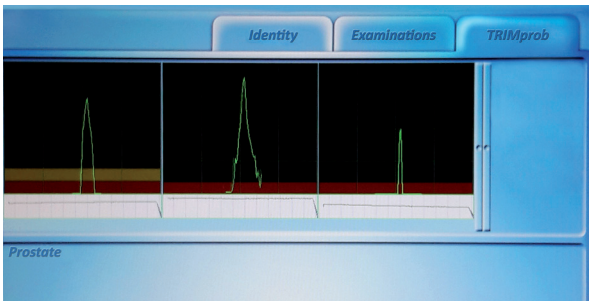

Fig. 2. TRIM bioscanner: the spectrum of the electromagnetic waves in absence of tissue alteration.

In conclusion, the TRIM represents a future challenge for early cancer screening; however, further population studies on a large series are needed, to confirm the data already available and to extend the trials to other body areas.

Acknowlegdements:
Vittorio Rubino, for the cooperation and expertise in the field.

Authors Disclosure
The Authors declare that they have no conflict of interests

REFERENCES

1. Pokorný J, Pokorný J, Foletti A, Kobilková J, Vrba J, Vrba J Jr. Mitochondrial dysfunction and disturbed coherence: gate to cancer. Pharmaceuticals (Basel) 2015; 8: 675-695.
2. Pokorny J, Vedruccio C, Cifra M, Kucera O. Cancer physics: diagnostics based on damped cellular elastoelectrical vibrations in microtubules. Eur Biophys J 2011; 40: 747-759.
3. Brandon M, Baldi P, Wallace DC. Mitochondrial mutations in cancer. Oncogene 2006; 25: 4647-4662.
4. Pedersen PL. Warburg, me and hexokinase 2: multiple discoveries of key molecular events underlying one of cancers' most common phenotypes, the "Warburg Effect", i.e., elevated glycolysis in the presence of oxygen. J Bioenerg Biomembr 2007; 39: 211-222.
5. Da Pozzo L, Scattoni V, Mazzoccoli B, Rigatti P, Manferrari F, Martorana G, Pietropaolo F, Belgrano E, Prezioso D, Lotti T, Villari D, Nicita G. Tissue-resonance interaction method for the non-invasive diagnosis of prostate cancer: analysis of a multicentre clinical evaluation. BJU Int 2007; 100: 1055-1059.
6. Guimaraes GC, Costa WH, Rosa RA, Zequi S, Favaretto R. Predictive role of Trimprobe associated with multiparametric MRI in the diagnosis of prostate cancer. Int Braz J Urol 2017; 43: 29-35.

7. Tubaro A, De Nunzio C, Trucchi A, Stoppacciaro A, Miano L. The electromagnetic detection of prostatic cancer: evaluation of diagnostic accuracy. Urology 2008; 72: 340-344.
8. Gokce O, Sanil O, Salmasli oglu A, Tunaci A, Ozsoy C, Ozcan F. Tissue resonance interaction method(TRIMprobe) has the potential to be used alongside the recognized tests in the screening protocols for prostate cancer. Int J Urol 2009; 16: 580-583.
9. Gervino G, Autino E, Kolomoets E, Leucci G, Balma M. Diagnosis of bladder cancer at 465 MHz. Electromagn Biol Med 2007; 26: 119-134.
10. Cormio L, Vedruccio C, Leucci G, Massenio P, Di Fino G, Cavaliere V, Carrieri G. Non-invasive electromagnetic detection of bladder cancer. ISRN Urology 2014; ID 802328: 1-4.
11. Vannelli A, Leo E, Battaglia L, Poiasina E. Diagnosis of rectal cancer by electromagnetic interactions: preliminary results. Dis Colon Rectum 2009; 52: 162-166.
12. Vannelli A, Battaglia L, Poiasina E, Ermanno L. Diagnosis of rectal cancer by Tissue Resonance Interaction Method. BMC Gastroenterology 2010; 10: 45.
13. Dore MP, Tufano MO, Pes GM, Cuccu M, Farina V, Manca A, Graham DY. Tissue resonance interaction accurately detects colon lesions: a double-blind pilot study. World J Gastroenterol 2015; 21: 1-9.
14. De Cicco C, Mariani L, Vedruccio C, Ricci C, Balma M, Rotmensz N, Ferrari ME, Autino E, Trifirò G, Sacchini V, Viale G, Paganelli G. Clinical application of spectral electromagnetic interaction in breast cancer: diagnostic results of a pilot study. Tumori 2006; 92: 207-212.
15. Sacco R, Innaro N, Pata F, Lucisano AM, Talarico C, Aversa S. Preoperative diagnosis of incidental carcinoma in multinodular goitre by means of electromagnetic interactions. Chir Ital 2007; 59: 247-251.
16. Sacco R, Sammarco G, De Vinci R, Vescio G, Scarpelli A, Lucisano AM, Pata F, Mascia E, Martines V. Relief of gastric cancer with an electromagnetic interaction system (TRIM probe) in outpatients. Chir Ital 2007; 59: 823-828.