



**Tumour Trace classifies
cervical cancer with
95.24% sensitivity
100% specificity**



Classification of Cervical Smears at the Clinic of Gynaecology and Obstetrics, Narodni Front, Serbia.

Tumour Trace technology classifies healthy/cancerous cervical smears.

Research Study was conducted by

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Period of study

January 2011 – December 2015

Location

Clinic for Gynaecology and Obstetrics Narodni Front, Belgrade, Serbia (GAK)

GAK was founded in May 26, 1953 and is a tertiary level, preventive, curative institution, providing inpatient and outpatient-polyclinic health care to residents of the Republic of Serbia. In addition, this clinic provides the area of Belgrade with a secondary level of health care in the field of Gynaecology and Obstetrics. In the provision of medical services, GAK, provides preventive diagnostic and therapeutic medical services in the following areas of health care; specialization; respective subspecialisation of obstetrics and gynaecology; pediatrics; transfusion; medical biochemistry and internal medicine. The clinic employs 19 teachers from the Faculty of Medicine, of which 14 are professors, five assistant professors and one assistant. Within its teaching activities, the clinic provides practical education and training for students studying basic medical studies and Postgraduate studies, in the field of Gynaecology and Obstetrics. At the clinic, Postgraduate, Masters and Doctoral studies are offered. Annually, there are around 400 students and physicians who undertake some form of education.

Background

Cervical cancer is the fourth most common cancer worldwide. The incidence rates are higher in less developed countries, where screening programs are not available to the same extent as in developed countries.

PAP Group	Bethesda Classification
Pap II	Samples that have no cell abnormalities, reported as negative for intraepithelial lesion or malignancy, and they can also include certain benign findings (infections, inflammations)
Pap IIIa	ASC-US/ASC-H/AGUS
Pap IIIb	LSIL/HSIL
Pap IV	HSIL/AIS
Pap V	Invasive carcinoma (Squamous/glandular/other cell type carcinoma)

Existing accuracy based on PAP test: 65.6%

Material

PAP smears (Papanicolaou test) – all samples were prepared according to standard procedure of PAP preparation at GAK. The cervical cells are taken with a wooden scraper and a cervical brush and are then placed on microscopic glass slides. Cells scraped from the surface of the cervix are usually placed on one microscopic slide and cells scraped from the inside of the cervical canal are placed on another slide. After adding a fixative, cells are stained and then analysed under a microscope. This conventional Papanicolaou procedure is used to detect precancerous and cancerous changes in cervical cells. The procedure includes sample staining with orange and polychrome stain, and washing with ethanol after each of these stains has been added to the sample. The PAP test categorizes samples into four groups: PAP group 2 (atypical cells with no evidence of malignancy-Normal), PAP group 3 (low cells suspicious of malignancy- Low Grade), PAP group 4 (high suspicious to be malignant cells – High Grade) and PAP group 5 (large number of malignant cells- Cancer).

Total number of samples: **1350 stained samples and 550 unstained samples. Number of cancers detected was 190.**

Results

Opto-magnetic imaging spectroscopy (OMIS) showed clear classification between healthy and unhealthy smears and also good classification between each of four groups. From the results of unstained samples it can be said that we have higher sensitivity and that this sensitivity is highly influenced by the fixing and staining procedure. Our sensitivity between 2nd and 3rd PAP group is 95.24% and specificity reached 100%.

Stained samples gives both high sensitivity and specificity (between 2nd and 3rd group 99% and 86.96%, 2nd and 5th group 99% and 95.24%).

Unstained Samples		Sensitivity	Specificity	Accuracy
Inner	2 and 3	95.24%	100.00%	97.50%
Outer	2 and 3	94.74%	90.48%	92.50%

Stained Samples		Sensitivity	Specificity	Accuracy
Inner	2 and 3	99%	86.96%	92.50%
	2 and 5	99%	95.24%	97.50%
Outer	2 and 3	99%	78.43%	86.75%
	2 and 5	99%	90.70%	95.00%

Figure 3. Tables of sensitivity, specificity and accuracy between PAP groups.

Spectral differences observed between the four categories reflect in intensity variations. Peak intensities of malignant cells are lower than peak intensities of normal cervical cells. There is also a noticeable shift in peak positions.

Opto-magnetic imaging spectroscopy (OMIS) as a new non-invasive method successfully characterizes cervical smear samples according to the existing four group classifications. Average accuracy is about 95%. It can be said that this method can be used for screening and it can help in early cancer detection.

