

# A Survey on Analysis of Malignant Cervical Cells Based on N/C Ratio

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**Abstract** - This paper presents an analysis of abnormal cervical cells based on nucleus/cytoplasmic (N/C) ratio. With the help of N/C ratio one can distinguish between normal and abnormal cervical cells. This method uses MATLAB to analyse the Pap smear images. Pap smear test is a simple harmless test that is used in diagnosis of cervical cancer. This may help pathologist in identification of cancer affected cells at prior stages and help in prevention of cervical cancer

**Key Words:** : Pap Smear, Nucleus/ Cytoplasmic Ratio, MATLAB

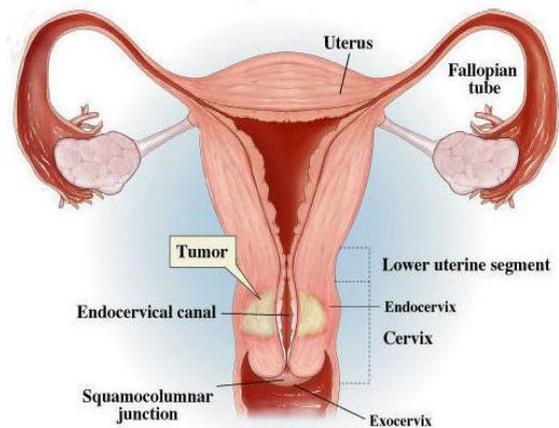


Fig 1. Cervical Cancer

## 1. INTRODUCTION

Cervical cancer is one of the most common cancers in women worldwide. Cervical cancer, in women, is the second most common cancer worldwide, next only to breast cancer. In India, cervical cancer is the most common woman-related cancer, followed by breast cancer. Every year cervical cancer is diagnosed in about 500,000 women globally and is responsible for more than 280,000 deaths annually.<sup>[1]</sup>

### 1.1 CERVICAL CANCER

Cervical cancer starts in the cells lining the cervix -- the lower part of the uterus (womb). This is sometimes called the uterine cervix. The fetus grows in the body of the uterus (the upper part). The cervix connects the body of the uterus to the vagina (birth canal). The part of the cervix closest to the body of the uterus is called the endocervix. The part next to the vagina is the exocervix (or ectocervix). The 2 main types of cells covering the cervix are squamous cells (on the exocervix) and glandular cells (on the endocervix). These 2 cell types meet at a place called the transformation zone. The exact location of the transformation zone changes as you age and if you give birth.

Most cervical cancers begin in the cells in the transformation zone. These cells do not suddenly change into cancer. Instead, the normal cells of the cervix first gradually develop pre-cancerous changes that turn into cancer. Doctors use several terms to describe these pre-cancerous changes, including cervical intraepithelial neoplasia (CIN), squamous intraepithelial lesion (SIL), and dysplasia. These changes can be detected by the Pap test and treated to prevent cancer from developing

## 2. DIAGNOSIS OF CERVICAL CANCER

Cervical cancer is commonly diagnosed through a Pap smear, complemented by a pelvic examination. It is advisable for women who are above the age of 18 years and who are sexually active to undergo routine screening as this helps in the early detection of cervical cancer, which is completely curable if diagnosed early.

**Pap smear:** The Pap smear is one of the greatest success stories of preventive medicine. It is done by inserting a speculum into the vagina and removing cells, from the lining of the cervix, using a cotton swab or a spatula. The cells are then smeared on a glass slide and sent for microscopic examination.

The test is not considered for women below the age of 25 years and over the age of 65 years. A 3- yearly examination is recommended for women between the ages of 25 -49 years

while for the age group between 50-64 years a Pap smear once in every 5 years is recommended. Women who are currently not active sexually, but were in the past, should continue to screen routinely. Pelvic examination of the vagina and the adjacent organs include a visual examination using a speculum and palpating using a gloved finger.

Other diagnostic tests comprise of a Colposcopy which enables a detailed visual examination of the cervix using a Colposcope, and Cone biopsy which removes a cone-shaped tissue from the cervix to be examined microscopically. An endocervical Curettage scrapes down the lining to be examined for abnormal changes.<sup>[2]</sup>

After getting images from Pap Smear test, they are processed with the help of various image processing techniques. In this paper we are taking survey of image analysis method which is based on Nucleus/ Cytoplasmic ratio (N/C Ratio).

### 3. NUCLEUS/ CYTOPLASMIC RATIO

The nucleus-cytoplasmic ratio (also variously known as the nucleus:cytoplasm ratio, nucleus-cytoplasm ratio, N:C ratio, or N/C) is a measurement used in cell biology. It is a ratio of the size (i.e., area) of the nucleus of a cell to the size of the cytoplasm of that cell. The N:C ratio indicates the maturity of a cell, because as a cell matures the size of its nucleus generally decreases. So, one can find the N/C ratio as follows:

$$N/C \text{ ratio} = (\text{Area of nucleus}) / (\text{Area of the cytoplasm}).$$

That means if area of the nucleus and cytoplasm are calculated then from above equation one can calculate the N/C ratio easily. In a normal cell, nucleus consumes very less amount of area than an abnormal cell's nucleus. And on the other hand cytoplasm of a normal cell consume larger amount of area than an abnormal cell. So if one find out the N/C ratio based on this concept then it can be explained that N/C ratio of a normal cell is less than N/C ratio of an abnormal cells. Fig 2 shows the area consumed by normal and abnormal cell's nucleus and cytoplasm. In our approach we tried to find out N/C ratio of nearly 100 individual cells obtained from the Pap smear images. <sup>[2]</sup>

### 4. STEPS USED BY THIS METHOD

Step 1. Calculation of nucleus area :

After getting coloured image from Pap Smear test, it is important to convert into gray image as coloured images are difficult to process. Then using pre-processing techniques it will converted into suitable form as per given in the following image. And the nucleus area will be evaluated.

Step 2. Calculation of cytoplasm area:

By using same pre-processing techniques area of cytoplasm will be evaluated. But is also contains area of nucleus. Hence we will subtract area of nucleus from area of cytoplasm to get required area of cytoplasm.

Step 3. Calculation of N/C ratio from the outputs obtained from step1 and step2 and its analysis.

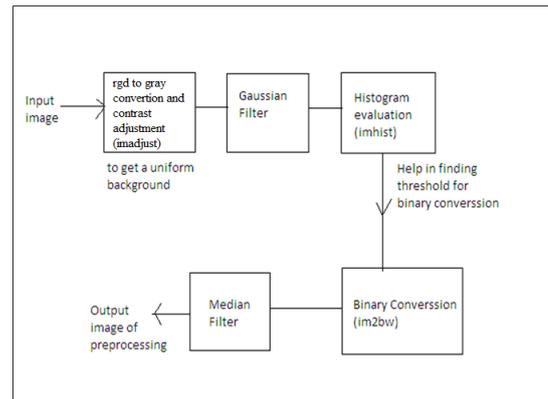


Fig2. Pre-processing Part

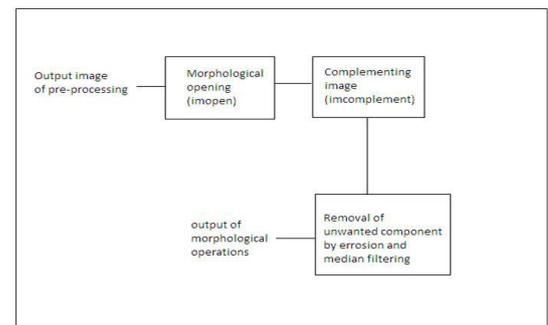


Fig 3. Morphological Operations

### 3. Result

After analyzing various pap smear images, researchers got following results-

1. Abnormal cells has large nucleus than normal cells
2. If N/C ratio is less than 1, then shows normal cells
3. If N/C ratio is greater than 1, then shows abnormal cells

### 3. CONCLUSIONS

From this proposed method we came to conclusion that abnormal cells can be easily detected from their N/ C ratio. From this detection of cancerous cells at early stages is possible.

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