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Overview On Application Of "Internet Of Things (IoT)" For Cervical Cancer Screening

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ABSTRACT :

Women's cervix, which connects the uterus and vagina, is where cervical cancer develops when cells in the cervix alter. The deeper tissues of their cervix may be affected by this cancer, and it has the potential to metastasis (spread to other parts of the body), most frequently the lungs, liver, bladder, vagina, and rectum. The application of the Internet of Things (IoT) to the treatment of cancer patients has been investigated, and the outcomes are encouraging. This paper reflects critical study on the application of "Internet of Things" for Cervical Cancer Screening.

KEYWORDS : cervical , cervix , " Internet of Things" , cancer

I INTRODUCTION:

A cancer that starts in the cervix is called cervical cancer. It is caused by cells that have the capacity to invade or disseminate to different places of the body growing abnormally. Early on, there are frequently no signs visible. Later signs and symptoms could include abnormal vaginal bleeding, pelvic pain, or discomfort during sex. While bleeding after sex might not be a significant problem, it could also be a sign of cervical cancer.

More than 90% of cases are caused by human papillomavirus (HPV), yet the majority of women who have had HPV infections do not go on to develop cervical cancer. Nearly 50% of high-grade cervical pre-cancers are caused by HPV 16 and 18 strains. Smoking, a weakened immune system, birth control pills, beginning sex at a young age, and having numerous sexual partners are other risk factors, albeit they are less significant. Cervical cancer risk is also influenced by genetic factors. Precancerous alterations usually lead to cervical cancer over the course of 10 to 20 years. Squamous cell carcinomas make up about 90% of instances of cervical cancer, adenocarcinomas make up 10%, and other kinds make up a tiny minority. Typically, a biopsy is performed after a cervical screening for diagnosis. The next step is to perform medical imaging to check for the spread of the cancer.

Up to 90% of cervical malignancies may be avoided with HPV vaccinations, which offer protection against two to seven high-risk variants of this family of viruses. According to recommendations, routine Pap testing should continue as long as there is a chance of cancer. Utilizing condoms and having few or no sexual partners are two more preventative strategies. Precancerous alterations can be found during a cervical cancer screening using the Pap test or acetic acid, which when treated, can stop the growth of cancer. Radiation therapy, chemotherapy, and surgery may all be used as treatment options. Five-year survival rates in the United States are 68%. However, outcomes greatly depend on how quickly the malignancy is found.

Cervical cancer is the fourth most prevalent cancer form and the fourth leading cause of cancer death in women in the world. There were 266,000 fatalities from cervical cancer in 2012, according to estimates of 528,000 new cases. This represents around 8% of all cancer cases and deaths combined. In developing nations, 90% of cervical cancer cases and deaths take place. It is one of the most prevalent causes of cancer death in low-income nations. Cervical cancer rates have significantly decreased in developed nations thanks to the widespread adoption of cervical screening programmes. Given assumptions regarding the achievement of advised prevention targets utilising triple-intervention techniques established by WHO, expected scenarios for the reduction of death due to cervical cancer worldwide (and particularly in low-income countries) have been assessed. The most well-known immortalised cell line in medical research, called HeLa, was created from Henrietta Lacks' cervical cancer cells.

There may be no signs or symptoms at all in the early stages of cervical cancer. The presence of cancer may be indicated by vaginal bleeding, contact bleeding (of which the most frequent type is bleeding after sexual contact), or (rarely) a vaginal mass. Additionally, vaginal discharge and mild pain during sex are signs of cervical cancer. Metastases in the abdomen, lungs, or elsewhere may be found in a disease that has advanced.

Loss of appetite, weight loss, weariness, pelvic pain, back pain, leg pain, swollen legs, heavy vaginal bleeding, bone fractures, and (occasionally) urine or faeces leaks from the vagina are all signs of advanced cervical cancer. Bleeding following a pelvic exam or after douching is a typical sign of cervical cancer.

Today, the internet has taken a significant place in our daily lives. Imagine a scenario in which several things may perceive, converse, and exchange data via a private Internet Protocol (IP) or public networks. The interconnected objects provide an intelligent network for analysis, planning, and decision-making by regularly collecting data and using it to start the necessary actions. The Internet of Things is a reality in this era (IoT). IoT is typically understood to be the process of connecting physical items to the Internet and then using that connection to operate or remotely monitor those objects. The creation of a dazzling, invisible network that can be sensed, controlled, and programmed is the true definition of the Internet of Things. The sensors, gateway, and wireless

network that support the overall IoT concept allow users to communicate and obtain information.

II INTERNET of THINGS (IoT):

The term "Internet of things" (IoT) refers to physical objects (or groups of such objects) equipped with sensors, computing power, software, and other technologies that communicate with one another and exchange data through the Internet or other communications networks. The term "internet of things" has been criticised because devices only need to be individually addressable and connected to a network—not the whole internet.

The Internet of Things (IoT) ecosystem is made up of web-enabled smart devices that use embedded systems, such as processors, sensors, and communication gear, to gather, send, and act on the data they get from their surroundings. By connecting to an IoT gateway or other edge device, which either sends data to the cloud for analysis or analyses it locally, IoT devices exchange the sensor data they collect. These gadgets converse with other similar devices on occasion, acting on the data they exchange. Although individuals can engage with the devices to set them up, give them instructions, or retrieve the data, the gadgets accomplish the majority of the job without their help.

IoT in Health Care System:

Remote monitoring in the healthcare industry is now possible thanks to Internet of Things (IoT)-enabled devices, releasing the potential to keep patients safe and healthy and enabling doctors to provide excellent treatment. As doctor-patient interactions have gotten simpler and more effective, it has also raised patient participation and satisfaction. Additionally, remote patient monitoring shortens hospital stays and avoids readmissions by keeping an eye on patients' health. IoT has a huge impact on lowering healthcare expenses and enhancing patient outcomes.

Without a doubt, IoT is revolutionising the healthcare sector by changing how devices and people interact while providing healthcare solutions. Applications of IoT in healthcare are advantageous to patients, families, doctors, hospitals, and insurance providers.

III DIAGNOSIS OF CERVICAL CANCER:

Although the Pap test can be used as a screening tool, up to 50% of cervical cancer cases result in a false negative. Other issues include the price of doing Pap tests, which makes them prohibitively expensive in many parts of the world.

A cervix biopsy is necessary for the confirmation of the diagnosis of cervical cancer or precancer. Colposcopy, a magnified visual examination of the cervix, is frequently used to accomplish this. Lugol's iodine is used to stain the normal tissues a mahogany brown to provide visual contrast, and abnormal cells are highlighted on the surface of the cervix

using a dilute acetic acid (vinegar) solution. Punch forceps are a common piece of medical equipment used for cervix biopsies. Colposcopic impression, a visual inspection-based assessment of the disease's severity, is a component of the diagnosis. Additional diagnostic and therapeutic techniques include cervical conization, in which the cervix's inner lining is removed for pathological analysis, and loop electrical excision. If the biopsy reveals significant cervical intraepithelial neoplasia, these procedures are performed.

The cervix has been completely destroyed and the lower uterine segment has been invaded by this big squamous carcinoma (bottom of image). Additionally, the uterus bears a circular leiomyoma higher up.

The doctor frequently orders medical imaging before the biopsy in order to rule out other potential reasons of the woman's complaints. To look for alternating illness, tumour spread, and effects on nearby structures, imaging techniques such ultrasonography, CT scan, and MRI have been employed. On the cervix, they typically manifest as a heterogeneous mass.

Interventions such as playing music throughout the operation and seeing the procedure on a monitor can minimise the anxiety associated with the test.

IV VACCINATION FOR PREVENTING CERVICAL CANCER:

Cervical and perineal cancer or precancerous alterations are prevented by three HPV vaccines (Gardasil, Gardasil 9, and Cervarix) by roughly 93% and 62%, respectively. Up to at least 8 years, the vaccines are between 92% and 100% effective against HPV 16 and 18.

Since the vaccine is most effective if administered before illness arises, it is commonly given to individuals between the ages of 9 and 26. Unknown are the effectiveness's timeframe and whether a booster is required. It has been a source of concern that this vaccine is so expensive. Numerous nations have thought about (or are thinking about) funding initiatives for HPV vaccination. There are suggestions for various degrees of resource availability in the American Society of Clinical Oncology guideline.

Since 2010, young women in Japan have been allowed to obtain the cervical cancer immunisation for free. The Japanese Ministry of Health, Labor, and Welfare ordered that medical facilities must warn women that the ministry does not advise getting the vaccine before giving it to them in June 2013. For Japanese women who decide to get the vaccination, the vaccine is remains free of charge.

V CERVICAL CANCER SCREENING:

Pap Testing :

Women need to be aware of cervical cancer, according to the World Health Organization. Furthermore, screening for cervical malignant growth is constrained by viewpoints on sexual wellness, an open discussion of sexual behaviour, and personal values. The

literature has shown a lack of knowledge regarding cervical disease screening, and some women have reported not being aware of the benefits of early detection. There are socioeconomic divisions as well; these divisions include neediness, lack of access to transportation, and immigration status. According to data from the 2005 Health Information National Trends Survey, people who continue to smoke are much less likely to have the recommended Pap exams. Obesity, another risk factor for cervical malignant development, was strongly linked to falling behind on routine screening procedures. Perceived barriers to a real Pap test have been taken into account. Ladies stated not anticipating the apparent obtrusiveness of the Pap test, low solace linked with the test, worry about the probable outcomes of the test, and hesitance to screen following an awful encounter as justifications behind not obtaining screenings. Individual barriers to testing are important, but it's also important to understand why suppliers don't follow the present screening guidelines. Evidence shows that HCPs have screened women before proposals and have continued to screen them even when the guidelines indicate that such screening is not necessary.

HCPs should get updated training on cervical disease screening guidelines. While supporting the presently proposed screening rules, competent organisations should concentrate on informing HCPs about the changes. Frameworks for medical services may play a key role in improving conformity to the law. Guidelines can be communicated to HCPs and the general public through framework informing. One more effective method for alerting HCPs of unethical cervical disease screening techniques and what standards are upheld by professional organisations is to use clinical record updates.

Increasing contact between patients and providers is one way to improve screening. For patients to benefit from early discovery, open communication is crucial. Information on cervical disease screening guidelines and the necessity to complete recommended Pap tests can also be developed at informative seminars. In one study, neighbourhood health workers that trained Hispanic women had more knowledge and mentioned getting a Pap test. For both men and women, educational messages concerning HPV infection and vaccination need to change to some extent. Females need to be educated on the risks associated with early sexual activity, having many sex partners, having a partner who has had many partners, and having intercourse with uncircumcised males. Additionally, it has been reported that females have expressed greater concerns regarding the efficacy or security of HPV vaccinations; as a result, education should concentrate on removing these obstacles. Males need to be aware of the risks of HPV transmission from one sex partner to another and how to properly use plastic condoms each time they engage in sex. For men, the cost of having an HPV vaccination is a more significant barrier. As a result, educational messaging should identify the best times to obtain the antibody or point patients in the direction of a facility that provides the immunisation at a discounted charge.

Pap Smear System :

In the Papanicolaou smear method, a small cytological material from the uterine cervix is taken with a specific cyto-brush and spread onto a glass slide in order to identify pre-cancerous cells in the uterine cervix. The Papanicolaou procedure is then applied to stain the slide. Specific colours are used to emphasise the various parts of the cells. The cells on the glass slide are then examined under a microscope by cytotechnicians to determine the intensity of the precancerous cells.

Cytotechnicians employ a variety of criteria to diagnose cells. The nucleus and cytoplasm's dimensions, hue, form, and texture are taken into account. The diagnosis may be impacted by the cell density in a particular region. Differentiating between the various cells requires a qualified cytotechnician. Up to 3,000,000 cells can be found on each glass slide. Therefore, studying the slides manually takes a lot of time. This presents a chance for researchers to automate this laborious operation.

Ideally, samples are collected from various cervix regions. The cyto-brush, cotton stick, or wooden stick are utilised, depending on the location. Cells from the squamous epithelium and columnar epithelium are most frequently found in the specimens. The squamous epithelium is found in the lower portion of the cervix, whereas the columnar epithelium is found in the higher portion. The metaplastic epithelium, also known as the transformation zone, is situated in the space between these two regions. Numerous cytotechnicians look at hundreds of thousands of cells on a single Pap smear slide under a microscope to identify premalignant cell alterations based on the cell's size, colour, shape, and cytoplasm and nucleus features.

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