Epidemiological survey of risk factors and prevalence of cervical cancer in Andhra Pradesh, India

Subramanyam Dasari¹, Wudayagiri Rajendra² and Lokanatha Valluru¹*

¹Department of Biotechnology, Dravidian University, Kuppam, A.P, India.
²Department of Zoology, Sri Venkateswara University, Tirupati, A.P, India.
*For Correspondence - lokanath.valluru@gmail.com

Abstract
To evaluate the epidemiological survey and the prevalence of cervical cancer in Andhra Pradesh, India. The incidence of cervical cancer data were extracted from Medical Colleges and its associated hospitals from 2009 to 2012. Amongst all the surveyed cases (6,971) 29.5% are cervical cancer cases with 28.1% of stage I, II and 71.8% cases are in advanced stages. Among the suspected cases, Pap smear results indicated that the 27.3% of cases are adenocarcinoma in situ and following atypical squamous cell of undifferentiated significance. Majority surveyed patients use tobacco products (20.1%) followed by contraceptive pills (17.95%) and areca nut products (6.2%). In conclusion, cervical cancer was the second most leading cancer among the women in Andhra Pradesh and its occurrence is mainly due to the infection of human papilloma virus and then followed by bacterial and fungal infections and other risk factors respectively.

Key Words: Areca nut, Cervical Cancer, Contraceptive Pills, Pap smear, Risk factors.

Introduction
Cancer is one of the leading causes of adult deaths across the worldwide especially developing counties like India (1). The exact number of cancer deaths in India is expected to increase because of increased population growth. Rates of cancer deaths are expected to rise, particularly from increases in the age-specific cancer risks of tobacco smoking, which increase the incidence of several types of cancer (1). India is a culturally and traditionally diverse country, with huge regional and rural-to-urban variation in lifestyles and in age-specific adult death rates. Thus, understanding the geographical and social distribution of specific cancers is essential to target cancer control programmes and spur further research into the causes of cancer. There are 24 urban population-based cancer registries in India, with only two registries representing rural areas (2). All the urban Population Based Cancer Registries such as Bangalore, Bhopal, Chennai, Delhi and Mumbai have shown a statistically significant decrease in prevalence of cancer (2). Since over 70% of the Indian population exist in the rural areas, cancer of uterine cervix still constitutes the number one cancer in females (3). The HPV virus takes very long progression time from mild dysplasia to carcinoma makes cervical cancer a relatively easily preventable disease and provides the rationale for screening. Most women who develop cervical cancer tend to have one or more recognizable co-factors that increase their risk efficiency for the disease. It is uncommon but not impossible for women to develop cervical cancer without any of these risk factors (4).

According to GLOBOCAN 2012, global burden rises to 14.1 million new cases and 8.2 million cancer deaths in 2012, compared with 12.7 million and 7.6 million, respectively, in 2008. A significant increase was noticed in breast and
cervical cancers in 2012 (5,6). There will be almost 20 million new cases were estimated by the end of year 2020. It is not only in the number of new cases that will increase but also the proportion of new cases from the developing countries like India will also rise to around 70%. The magnitude of the problem of cancer in Indian Sub-Continent is disturbing (7). Though the cancer incidence rate in India is less than that of the Western countries but due to the large population size, number of cases is more prevalent at any time (8). The most common cancers among females are breast, cervix, ovary, oesophagus and mouth. Of this, cervical cancer is the second most common cancer among women worldwide after breast cancer. World Health Organization (WHO) reported that the cervical cancer comprises 12% of all cancers in women and it is the leading gynaecological malignancy in globally (9). It is an important public health problem especially for adult women in developing countries (10). The risk of cervical cancer remains high in many developing countries mostly due to the lack or inefficiency of existing prevention programmes.

Therefore, the aim of the present study was to evaluate the epidemiological survey of risk factors and prevalence of cervical cancer in Andhra Pradesh. The survey was based on the data available from medical colleges and its associated hospitals along with some cytopathological investigations in two medical colleges.

Methodology for Epidemiological survey
Medical Colleges and their associated Hospitals (Sri Venkateswara Medical College, Sri Venkatesewara Meternity Hospital, Tirupati, Guntur Medical College Guntur, PES Medical College Kuppam) present in the Andhra Pradesh, India were involved in order to conduct the cervical cancer/Pre-cancer prevalence. Clinical-epidemiological survey is based on the questionnaire elucidated in table 1, 2 and 3. Tables also shows that the total number of patients was arranged according to the age pattern with characteristic features of type and stage of the tumor, cervical data includes the cervical smears pH, Whiff test and presence or absence of microbial infections. The present survey contains two components firstly, knowledge about types of cancers, cancer stage, cervical data (pH, Whiff test), secondly, risk factors of cervical cancer including microbial infection along with number of childrens, pre or post menopause (11).

Results
In the present investigation, Table-1 shows that all the cancer and cervical cancer cases were arranged according to the year and stage wise. Among all the surveyed cancer cases (6971), 29.5% cases are cervical cancer (2058) with 28.1% of stage I, II (579) and 71.8% cases are in advanced stages (stage III, IV) (1479).

Table-2 shows that the surveyed cervical cases were arranged according to the age, type of their cells, stage and cervical swab data. Among all the cervical cancer cases 35.9% cases are Squamous Cell Carcinoma (SCC) and 27.3, 22.4% are adenocarcinoma and Squamous Cell adenocarcinoma respectively with affect age maximum at 60-69 years and minimum affect at the age of 30-39 years. Based on the cancer stage, maximum cases are identified at the age of 60-69 years. In 92.8% cervical cases, vaginal pH was observed as greater than the 5, which indicates that the most of the cases shows increased pH due to the presence of anaerobic bacteria. Approximately 98.2% cases were positive for Ames test. Of the surveyed cervical cases, 38.6% cases were affect the bacterial infections and then followed by fungal (25.8%) and fungi with candida infection (26.1%) respectively.

Epidemiological studies have identified a number of risk factors such as infection with high risk human papillomaviruses (HR-HPV), contraceptive pills (12) and usage of tobacco, areca nut products and other factors. Majority of the cases were due to the HR-HPV, 17.95% patients were used contraceptive pills, 6.2%
Epidemiological survey of cervical cancer in Andhra Pradesh

patients were used tobacco products, 20.1% patients were used areca nut products (Table-3). Table-3 also shows that increased number of childrens also increases the prevalence of cervical cancer. In the present study, nearly 54% of cases are having more than 2 childrens and 9.4% of cervical cancer patients have no children.

Table-4 indicated the, patients with gynaecological problems and suspected cervical cancer cases (Abnormal cervical cytology with undifferentiated pap smear results) reported only from two medical colleges (Guntur Medical College, Guntur and PES Medical College, Kuppam). Among all the suspected cases (2841 cases) 27.2% of cases are adenocarcinoma in situ and followed by Atypical squamous cell of undifferentiated significance, low grade squamous intraepithelial lesions and high grade squamous intraepithelial lesions (22.6%, 18.6%, 18.0 %) respectively.

Discussion

India has a population of approximately 1.2 billion and accounts for a significant burden of cervical cancer in the Indian subcontinent (3). There is an estimated annual global incidence of 5,00,000 cancers, in that India contributes 1,00,000 i.e., one-fifth of the world burden (13). A total of 4304 cervical cancer cases were registered during 1982-89 in the Chennai registry, India. In 1990, twenty percent of all female deaths from cancer in India, were from cervical cancer, amounting to an estimated 6,100 deaths (14). In 1996, cervical cancer accounted for 2,47,000 deaths in women. Approximately 20,000 new cases were detected in India, in the year 2000 (15). Recently a report says that there are an estimated 1.32 lakh new cases and 74,000 deaths annually in India (16). Particularly, in Southern India, carcinoma of the uterine cervix is the most common form of cancer in females (13).

The HR-HPV prevalence rates varied between 23-80%, but mostly above 20%. In the present study, the surveyed patients were at the age group of 30-79 years with a mean age of 56.8 years. 29.8% of the patients are under the middle age (55-65 years) with significant cancer characters, hence increased age increases the prevalence of the cancer, especially the median age at 58.5 shows the maximum occurrence of the disease.

In cytopathological studies of the cervical swab samples indicates that the 38.6% of cases were infected with bacterial infections and 25.8% cases were infected with fungi and 26.1% infections were considered as mixed infections containing fungi with candida. Bacterial infection involves the lower genital tract and is characterized by the replacement of Lactobacilli predominant flora with G. vaginalis, anaerobes and Mycoplasma hominis.

Kian Behbakhht and co-workers (17) reported that the elevated levels of microbial population especially bacterial infections in swab smears of cervical cancer patients. In the present study also 38.6% cases were infected with bacterial infection, most of these bacteria creates an anaerobic environment which increases the normal pH of the vagina from 4 to above 8 (18). The anaerobic bacteria present in the vagina produce mucin degrading enzymes which are responsible for the entry of HPV virus and causes the precancerous stage. Another important finding stated that the nitrosamines produced by the bacteria play a major role in the development of pre-cancerous stage (19).

The present study showed that the most of the patients with bacterial infections were develops the precancerous stage of cervix with CIN properties. The similar types of results were also reported at Nam et al. (20) who showed that the incidence of CIN changes was significantly higher in women with bacterial infections.

The development of cervical cancer was also associated with the number of pregnancies or number of children’s. HPV infected women who gave 2 or more births have twice the chance of developing cervical cancer compared to those who have no child (21). Higher level of knowledge was observed regarding the different risk factors.
of cervical cancer by the usage of carcinogenic products. Of the surveyed patients 17.9% patients were used contraceptive pills to prevent the pregnancy, 20.1% patients were used areca nut products and 6.2% patients were used tobacco products. In concern to the Pap smear test and cytopathological studies similar findings were observed in study of Saha et al. (2010) (22) and Teresa Joy et al. (2011) (23). The products of tobacco and areca nut also produce nitrosamines which facilitate the increased rate of cervical cancer in the patients who frequently use the products of tobacco and areca nut.

Cervical cancer Trends in India and Andhra Pradesh State

The recent Indian censes (2011), shows that the population of India was the second largest in the world, with an estimated 1.2 billion people. Approximately 950,000 incidences of cancer cases and 6,34,000 associated mortalities reported in India in 2008 (24). Overall, the most commonly reported types of cancer in India were cervical, breast, lip/oral cavity, lung, and oesophagus (24). The maximum mortality rates, across both sexes were reported for cervical and breast cancer. According to India’s recent population census, if India’s population continues to grow at an annual rate of 1.4%, the population of India will likely more than that of China after 2030 years and leads to nearly one-fifth of the global population live in India, potentially making cervical cancer the single most common cancer in the world (25).

Across the India, rates of cervical cancer vary vastly by population, including those defined by geographic and demographic features. In India the second highest age specific rate of cervical cancer was reported among women in state of Andhra Pradesh, India (10). The information of cancer pattern and burden in India is based on the population based cancer registries covering approximately 4% of the total population. The estimated age standardized cervical cancer incidence and mortality rate around 30.7 and 17.8 per 100,000 respectively in 2002. The peak incidence was observed in the age of 70 years old women (26). Statistical data showed that the estimated number of cancer cases in Asian and Indian woman is about 28,51,110 and 948,858 respectively with 23.3% of death rate in Indian Women (27).

There is no National Cancer Registry Programme (NCRP) or other cancer registry in Andhra Pradesh state and neither Cancer Incidence in Five Continents (CI5) publishes the data for Andhra Pradesh state. The Cancer Atlas of India publishes the data about Andhra Pradesh, for only 2 out of 23 districts.

Cervical Cancer Screening in India

Cervical cancer is preventable when it was identified as early as possible, but most women in poorer countries do not have access to effective screening programmes. There are no organized screening programs in any province or region of India. Screening of asymptomatic women is practically absent in well-organized health care programs of the industrial and military sectors (28). In India, it has been estimated that even with a major effort to expand cytological examinations, it will not possible to screen even one-fourth of the population once in a lifetime in the near future (29).

Cytology is offered sporadically to women in selected urban areas attending health services for other reasons, but not as routine screening of asymptomatic women. In 2002, according to a World Health Organization (WHO) health survey, 2.6% of 4,586 women aged 18–69 years, ever had a Pap smear (30). It is estimated that less than 1.5 million smears are opportunistically taken annually.

Incidence and Mortality Patterns in India

A large body of evidences stated that the cancer patterns and burden in India is based on the projections from 18 population-based cancer registries covering approximately 4% of the population, including three rural registries in different regions. Age standardized cervical cancer incidence rates range from 9 to 40 per 1,00,000 women in various regions of India (31).
The estimated age-standardized cervical cancer incidence and mortality rates around 2002 were 30.7 and 17.8 per 10000 women respectively. The highest incidence was observed in older women 70 years of age (26). The number of maternal deaths and cervical cancer cases is almost equal in India (30).

There is substantial awareness, advocacy and investment to reduce maternal deaths among policy makers, governments, professional societies (including the Federation of Obstetrics & Gynaecology Societies of India (FOGSI), social organizations and women’s movements. It is paradoxical that there is very limited awareness on cervical cancer as a threat to the health of middle-aged women in the most productive period of their life.

**Recommendations**

In the present survey and investigations contributed towards the much needed lag in the knowledge of cervical cancer, there is an urgent need to diagnosed or screen at early stage of the cervical cancer. In order to increase the knowledge of risk factors of cervical cancer, there is need for cervical cancer screening awareness program in rural and urban areas. More health education about cervical cancer could be made an integral part of different levels of health care systems in Andhra Pradesh, India.

This may also help to increase the knowledge of risk factors as well as remove the misconceptions about the cervical cancer. The current survey highlights about cervical cancer, its screening and prevention amongst the patients. Implementation of the screening educational sessions was successful in improving their knowledge. Women especially at the age of 50-60 years, properly aware of this disease and can educate masses, increase the health seeking behaviour in women and thus reduce the burden of cervical cancer.

**Conclusion**

In conclusion cervical cancer was the second most leading cancer among all the cancers in Andhra Pradesh. Epidemiological survey also concluded that contraceptive pills, tobacco products are the main risk factors for the development of cervical cancer.

**Conflict of Interest**

The authors declare that there is no conflict of interests for this article.

**Acknowledgements**

The authors extend their thanks to Dr. D.S. Raju Naidu, Head and Professor, Department of Radiation Oncology, Government General Hospital, Guntur, A.P, India for their help in the data documentation of cancer patients.

**Table 1.** Year wise data on all cancers along with cervical cancer during the period of 2009 to 2012: shows that 29.5% cases are cervical cancer with 71.8% cases are detected at advanced stages (Stage III & IV); 28.1% cases are diagnosed at stage I & II.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Cancer cases</th>
<th>Cervical Cancer (%)</th>
<th>Stage –I &amp;II (%)</th>
<th>Stage –III &amp;IV (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>1098</td>
<td>494 (44.9)</td>
<td>103 (20.8)</td>
<td>391 (79.1)</td>
</tr>
<tr>
<td>2010</td>
<td>1910</td>
<td>562 (29.4)</td>
<td>168 (29.8)</td>
<td>394 (70.1)</td>
</tr>
<tr>
<td>2011</td>
<td>2114</td>
<td>546 (25.8)</td>
<td>193 (35.3)</td>
<td>353 (64.6)</td>
</tr>
<tr>
<td>2012</td>
<td>1849</td>
<td>456 (24.6)</td>
<td>115 (25.2)</td>
<td>341 (74.7)</td>
</tr>
<tr>
<td>Total</td>
<td>6971</td>
<td>2058 (29.5)</td>
<td>579 (28.1)</td>
<td>1479 (71.8)</td>
</tr>
</tbody>
</table>

**Note:** The data present in the table was extracted from surveyed Hospitals and their associated Medical Colleges. The data present within the parentheses is percent over total number of Patients.

Epidemiological survey of cervical cancer in Andhra Pradesh
Table 2. Characteristics of cervical cancer patients with different types, stages and microbial infections based on age factor include Squamous Cell Carcinoma; Adeno Carcinoma; cancer stage according to the TNM classification. Table also shows the pH and Whiff tests of the cervical swabs and microbial infections include bacterial fungal, fungi with candida.

<table>
<thead>
<tr>
<th>S.No</th>
<th>Age(Years)</th>
<th>Type of Biopsy</th>
<th>Cancer Stage</th>
<th>Microbial Infections</th>
<th>pH</th>
<th>Whiff tests</th>
<th>BI</th>
<th>FI</th>
<th>F+C</th>
<th>WI</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>30-39</td>
<td>SCC</td>
<td>Others I &amp; II</td>
<td>d”5, P &gt; 5</td>
<td></td>
<td>268, 104</td>
<td>82</td>
<td>68</td>
<td>19</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>40-49</td>
<td>SCC</td>
<td>Others I &amp; II</td>
<td>d”5, P &gt; 5</td>
<td></td>
<td>334, 12</td>
<td>162</td>
<td>80</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>50-59</td>
<td>SCC+AC</td>
<td>Others I &amp; II</td>
<td>d”5, P &gt; 5</td>
<td></td>
<td>432, 6</td>
<td>150</td>
<td>126</td>
<td>110</td>
<td>52</td>
</tr>
<tr>
<td>4</td>
<td>60-69</td>
<td>SCC+AC</td>
<td>Others I &amp; II</td>
<td>d”5, P &gt; 5</td>
<td></td>
<td>608, 7</td>
<td>256</td>
<td>171</td>
<td>119</td>
<td>68</td>
</tr>
<tr>
<td>5</td>
<td>70-79</td>
<td>SCC+AC</td>
<td>Others I &amp; II</td>
<td>d”5, P &gt; 5</td>
<td></td>
<td>381, 5</td>
<td>123</td>
<td>58</td>
<td>162</td>
<td>42</td>
</tr>
<tr>
<td>6</td>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2023, 35</td>
<td>795</td>
<td>533</td>
<td>539</td>
<td>191</td>
</tr>
<tr>
<td>7</td>
<td>%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>795, 533</td>
<td>539</td>
<td>191</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: SCC: Squamous Cell Carcinoma; AC: Adeno Carcinoma; SCC+AC: Squamous Cell Carcinoma+Adeno Carcinoma. P: Positive; N: negative; BI: Bacterial Infection; FI: Fungal Infection; F+C: Fungal with Candida Infection; WI: Without infection; %: Percent over Total number of Patients. The data present in the table extracted from surveyed Hospitals and associated Medical Colleges.

Table 3. Characteristics of cervical cancer patients with risk factors include that number of children, pre- and post-menopause; usage of contraceptive pills, tobacco, areca nut products and others.

<table>
<thead>
<tr>
<th>S. No</th>
<th>Age No.of Childrens</th>
<th>Menopause</th>
<th>Usage of Carcinogenic products</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Nil</td>
<td>d”2</td>
<td>&gt; 2</td>
</tr>
<tr>
<td>1</td>
<td>30-39</td>
<td>54</td>
<td>93</td>
</tr>
<tr>
<td>2</td>
<td>40-49</td>
<td>16</td>
<td>115</td>
</tr>
<tr>
<td>3</td>
<td>50-59</td>
<td>35</td>
<td>154</td>
</tr>
<tr>
<td>4</td>
<td>60-69</td>
<td>47</td>
<td>263</td>
</tr>
<tr>
<td>5</td>
<td>70-79</td>
<td>43</td>
<td>129</td>
</tr>
<tr>
<td>6</td>
<td>Total</td>
<td>195</td>
<td>754</td>
</tr>
<tr>
<td>7</td>
<td>%</td>
<td>09.4</td>
<td>36.6</td>
</tr>
</tbody>
</table>

Note: C.Pills: Contraceptive Pills; %: Percent over Total number of Patients (2058). The data present in the table was extracted from surveyed Hospitals and their associated Medical Colleges.
Table 4. Year wise data on Pap smear test results during 2009 to 2012 shows that 27.2% cases are Adeno Carcinoma In Situ followed by Low-grade (22.6%), high grade (18.6%) Squamous Intra epithelial Lesions; Atypical Squamous Cell Carcinoma (18.0%).

<table>
<thead>
<tr>
<th>Year</th>
<th>ASCUS (%)</th>
<th>LSIL (%)</th>
<th>HSIL (%)</th>
<th>ACIS (%)</th>
<th>Negative (%)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>106 (14.8)</td>
<td>187 (26.1)</td>
<td>107 (14.9)</td>
<td>205 (28.6)</td>
<td>110 (15.3)</td>
<td>715</td>
</tr>
<tr>
<td>2010</td>
<td>127 (17.9)</td>
<td>163 (22.9)</td>
<td>105 (14.8)</td>
<td>216 (30.4)</td>
<td>98 (13.8)</td>
<td>709</td>
</tr>
<tr>
<td>2011</td>
<td>136 (18.8)</td>
<td>159 (22.0)</td>
<td>163 (22.6)</td>
<td>185 (25.6)</td>
<td>78 (10.8)</td>
<td>721</td>
</tr>
<tr>
<td>2012</td>
<td>145 (20.8)</td>
<td>134 (19.2)</td>
<td>154 (22.1)</td>
<td>167 (23.9)</td>
<td>96 (13.7)</td>
<td>696</td>
</tr>
<tr>
<td>Total</td>
<td>514 (18.0)</td>
<td>643 (22.6)</td>
<td>529 (18.6)</td>
<td>773 (27.2)</td>
<td>382 (13.4)</td>
<td>2841</td>
</tr>
</tbody>
</table>

Note: ASCUS: Atypical Squamous Cell Carcinoma; LSIL: Low-grade Squamous Intra epithelial Lesions; HSIL: High-grade Squamous Intra epithelial Lesions; ACIS: Adeno Carcinoma In-Situ. Note: The data present in the table was extracted from surveyed Hospitals and their associated Medical Colleges. The data present within the parentheses is percent over total number of Patients.

References


