

**Research Note**

JMR 2019; 5(5): 224-226
 November- December
 ISSN: 2395-7565
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 www.medicinarticle.com
 Received: 22-11-2019
 Accepted: 23-12-2019

A note on mycoplasmal origin of cancer

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Abstract

The bacterial origin of cancer has so far been well documented by several scientists [7,26,27]. Similarly, some mycoplasmal infections have also been found to cause cancer in human. They are usually associated with some urinogenital infections and arthritis in human. The present paper deals with the study of different mycoplasmal infections developing cancer in association with various ailments and diseases in human.

Keywords: Mycoplasma, Cancer, Human disease.

INTRODUCTION

Mycoplasma are highly adaptable microorganisms causing chronic infections in human and animals. They have been very popular in causing the non-gonococcal urinogenital infections like urthritis, vaginitis, cervicitis, pelvic inflammatory diseases and arthritis. These infections if persisted for a longer period of time, it causes gastric, colon, renal, prostate, ovary and even breast cancers (Tsai *et al.* 1995, Feng *et al.* 1999, Cimolai 2001, Huang *et al.* 2001, Pahlivan *et al.* 2005, Jiang *et al.* 2008, Namiki *et al.* 2009, Mariotti *et al.* 2010, Yang *et al.* 2004 & 2010, Apostolou *et al.* 2011, Rogers 2011, Urbanek *et al.* 2011, and Reuven Afriat *et al.* 2013)^[2,9,11,18,21,25,28,31,32,33,36,37,39,40].

In 1960, for the first time *Mycoplasma* was isolated from the cancerous tissues (Tsai *et al.* 1995)^[36]. Since then, several studies have been put forward to verify the link between the *Mycoplasma* to cause cancer (Huang *et al.* 2001, Cimolai 2001 and Rogers 2011)^[9,18,33]. Morphologically, sickle shaped cells with hyperchromatic nucleus due to the increase of DNA is the first visual sign of transformation into cancerous cells. These *Mycoplasmas* are linked to the malignant transformation of cells *in vitro* (Ning and Shou 2004, Zhang *et al.* 2006 and Hu *et al.* 2014)^[17,29,42]. *Mycoplasma* damages the cells by releasing H₂O₂ and superoxide radicals. It causes RNA/DNA mutations of the host cells causing cancers. In addition, certain chromosomal abnormalities were reported in mycoplasmal infections, if it persists for a longer period of time (Tsai *et al.* 1995, Cimolai 2001 and Sinkovics 2012)^[9,35,36]. The present paper is an outcome of research work based on mycoplasmal origin of cancer. It describes the various mycoplasmal species causing different diseases and cancer in human.

Several species of *Mycoplasma* are frequently detected in different types of cancer cells. Some of them are as *Mycoplasma fermentans*, *Mycoplasma genitalium*, *Mycoplasma hyorhinis*, *Mycoplasma hominis*, *Ureaplasma urealyticum* and *Mycoplasma pneumoniae* (Table 1).

Table 1: A list of mycoplasmal origin of cancer

Sr. No.	Name of Oncogenic Mycoplasma	Types of Cancer (Suggestive Link)	References
1.	<i>Mycoplasma fermentans</i>	Inhibiting the Tumor Necrosis Factor (TNF) in mammalian cells	Gerlic <i>et al.</i> 2004 & 2007 ^[12,13]
2.	<i>Mycoplasma genitalium</i>	Prostate cancer	Namiki <i>et al.</i> 2009 ^[28]
3.	<i>Mycoplasma hyorhinis</i>	Gastric, colorectal and prostate cancer	Yang <i>et al.</i> 2004, Namiki <i>et al.</i> 2009, Mariotti <i>et al.</i> 2010, Urbanek <i>et al.</i> 2011 ^[25,28,37,40]
4.	<i>Mycoplasma hominis</i>	Prostate cancer	Barykova <i>et al.</i> 2011 ^[3]
5.	<i>Ureaplasma urealyticum</i>	Cervical cancer	Xiaolei <i>et al.</i> 2014 ^[38]
6.	<i>Mycoplasma pneumoniae</i>	Lung cancer	Pahlivan <i>et al.</i> 2004, Chanudet <i>et al.</i> 2007 ^[8,31]

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M. fermentans like other *Mycoplasmas* is characterized by the absence of a peptidoglycan cell wall having antibacterial resistance. This has been isolated from some immunocompromised patients (Yanez *et al.* 2013)^[41]. It causes the inhibitory effect on “Tumor Necrosis Factor” (TNF)- alpha- induced apoptosis resides in the membrane lipoproteins (Gerlic *et al.* 2004 and 2007)^[12,13]. Similarly, it inhibits the activity of PARP1 and alters the efficacy of its anti-cancer inhibitor (Reuven Afriat *et al.* 2013)^[32].

M. genitalium causes non-gonococcal urthritis, more prevalent than *Neisseria gonorrhoeae* but, less prevalent than *Chlamydia trachomatis* (Namiki *et al.* 2009)^[28]. This is an established sexually transmitted infection linked to human urthritis (Ishihara *et al.* 2004 and Hjorth and Jensen 2006)^[16,19]. This has also been found in immunocompromised patients causing mostly the prostate cancer (Namiki *et al.* 2009)^[28].

Swine are the natural hosts of *M. hyorhinae* which could induce apoptosis and malignant transformations in mammalian cells (Yang *et al.* 2010)^[39] associating with colorectal, gastric and prostate cancer (Mariotti *et al.* 2010 and Urbanek *et al.* 2011)^[25,37]. *M. hominis* is a sexually transmitted infection causing urthritis, cystitis, endometritis, chorioamnionitis, pleonephritis, pelvic inflammatory disease, male sterility and arthritis (Jansson *et al.* 1983 and Burdge *et al.* 1988)^[4, 20]. Association of *M. hominis* has also been reported with prostate cancer transmitting through vaginal intercourse, oral to genital intercourse and mother to infant's *in utero* (Barykova *et al.* 2011)^[3].

U. urealyticum is usually found in vagina but is not a part of healthy female vaginal microbiota. It causes non-gonococcal urthritis causing pelvic inflammatory disease developing typical burning and painful urination (Burnstein and Zenilman 1999, Larsen and Hwang 2010, Kenyon *et al.* 2013 and Clark *et al.* 2014)^[5,10,22,24]. Further, this is a common cause of pneumonia in newborns and its association with chronic lung disease (CLD) in premature infants have been reported (Hannaford *et al.* 1999)^[15]. *U. urealyticum* infection causes cervical intraepithelial neoplasia and cervical cancer (Xiaolei *et al.* 2014)^[38].

M. pneumoniae is generally found in the respiratory tract of infected person transmitted via droplets being easily disseminated in the air. It causes atypical pneumonia or walking pneumonia in human developing tracheobronchitis or chest colds, sore throats, fever with headache and ear infections as well as pneumonia. A dry cough is the associated characteristic symptom of this infection. They are attached with the lung cells capable of causing transformation in such a way that it may cause cancer in future (Pahlivan *et al.* 2004, Chanudet *et al.* 2007, Jiang *et al.* 2008, Sato 2007 and Rogers 2011)^[8,21,30,33,34]. Further, they have also been found to be associated with the childhood acute lymphoblastic leukemia (Hall 1985 and Alexander 1997)^[1,14].

CONCLUSION

Mycoplasmal diseases have usually been associated with some urinogenital infections and arthritis in human. But, only recently it has been proved that if these infections persisted for a longer period of time may cause cancer. As these mycoplasmal infections may sometimes, cause cancer in human, we should always be alert about it. Though, this is felt quite differently that not everyone who suffered will develop cancer in future but, unfortunately, who develops, certainly is his bad luck (Masroor *et al.* 2018 & 2019)^[26, 27].

Acknowledgements

This piece of research work is dedicated to the memory of Marhooma Hajjin Saira Bee urf “Bhabhi”, the mother in law's of my elder sister. The authors are also deeply appreciating the institutions concerned for providing us necessary facilities during the course of this research work.

Conflict of Interest

The authors have declared no conflict of interest. They have approved the final version of the manuscript contributing equally.

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