Available online www.jocpr.com

Journal of Chemical and Pharmaceutical Research

ISSN No: 0975-7384
CODEN(USA): JCPRC5

J. Chem. Pharm. Res., 2011, 3(6):514-520

Human cancer cell lines- A brief communication

C.P. Kashyap, Bandana Tikka, Shikha Sharma, Sweta Kumari, Priti Verma, Swati Sharma, *Vikrant Arya

College of Ayurvedic Pharmaceutical Sciences, Jogindernagar, Mandi, H.P., India

ABSTRACT

Cancer cell line selection serves as a milestone step for anti-cancer drug discovery. In this brief communication an attempt has been made to reviewed distinct human cancer (liver cancer, lung cancer, breast cancer, lymphoma, colon cancer, melanoma, leukemia, myeloma tumors, gastric cancer, promyelocytic leukemia, pancreatic adenocarcinoma, skin fibroblast cells, colorectal adenocarcinoma, oral squamous cell carcinoma, gynaecological cancer, larynx cancer, epithelial carcinoma etc.) cell lines (BEL-7402, NSCLC, NCI-H125, H157, MCF-7, MDA-MB-435, KATOIII, HL-60, Mia PaCa-2, NF-103, MCF-7, SK-OV-3, CAOV-3, RL95–2, KLE etc.) which have been screened by Cell proliferation/cytotoxicity assay, MTT assay, Radioimmunoassay, TUNEL assay, Anchorage independent clonogenic assay, Neyfakh assay, Caspase-3/9 assay etc. After the in vitro screen, the most sensitive cancer cell lines can be selected for further tested in xenograft or orthotopic tumor models in mice or rats (in vivo).

Key words: Cell line, Cancer, Tumour.

INTRODUCTION

In the last few decades, human immortal cancer cell lines (residents of cells from a multicellular organism which would normally not proliferate indefinitely but, due to mutation, have evaded normal cellular senescence and instead can keep undergoing division) have aggregated an accessible, easily usable set of biological models with which to examine cancer biology and to analyze the inherent efficacy of anticancer (natural, synthetic) drugs [1]. Drug resistance is one of the hefty hindrances to chemotherapy of cancer. Studies with cell lines can serve as an initial screen for agents that might regulate drug resistance. To establish more

appropriate models of drug resistance and explore whether the differences exist in the different drug resistant sublines selected by different treatments [2].

Cancer cell lines

The utility of cell lines acquired from tumors allows the investigation of tumor cells in a simplified and controlled environment. There are specific advantages and disadvantages to exploit cancer cell lines over animal models. These then dictate the nature of the experiment that can be organised. Firstly, the cost involved with sustaining them is significantly less than maintaining animal subjects. They are promptly available and research studies can be implemented relatively quickly.

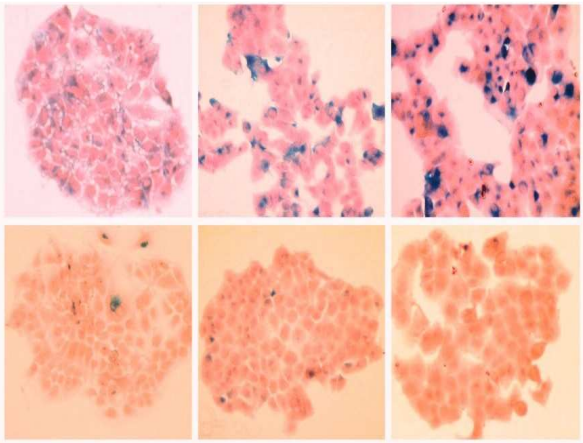

Fig. 1: Human cancer cell lines (HCC, T-47D, BT-474 generating senescence-associated *β*- galactosidase expressing progeny

Large quantities and volumes of cells may be propagated to create high-throughput studies. Cell lines are exceptionally versatile in the types of studies they may be used in. Not only can they be build *in vitro* but can also be injected into mice to form xenograft models of prostate cancer progression. They can be transformed and reviewed over time to dispose sequential events that occur as a result of specific stimulus. As well as the products produced from the cells such as their secretome can be analyzed readily. Disadvantages that are coupled with cell lines are that they do not represent the heterogeneity of the tumour microenvironment as well as the necessarily heterogeneous nature of tumours with a patient and between patients. As a result multiple cell lines may be required to address the full heterogeneity seen in a tumour phenotype. Cell lines are also subject to genetic alterations in culture that may alter their phenotype over the course of a long experiment. The path to the progression of the tumour is lost and does not provide insight in the pathogenic process significantly [3-10]. Applications of cell lines in distinct forms of cancers influencing vital organs like lung, prostate, breast, ovarian, colorectal, salivary, epithelial, larynx, liver *etc.* have been discussed below and listed in Table 1 [11-48].

Lung Cancer: In a study by Qin *et al*., (2009), in eight lung cancer cell lines, expression of *miR-126* was down-regulated. Reporter gene assay showed that the co-transfection of *mir-126* expression vector with pLuc-VEGF/mir*126BS* could reduce the activity of luciferase. Transfection experiments showed that *miR-126* could decrease the expression of VEGF-A. Three human lung carcinoma cell lines A549, Y-90 and SPC-A1 were investigated as cancer models *in vitro*, and A549 infected by lentivirus-miR-126 (LV-*miR- 126*) was studied in tumor xenograft model. Infection of LV-*miR-126* can down-regulate the expression of VEGF-A in A549, Y-90 and SPC-A1 cell lines and can inhibit the growth of these cells [35].

Human Breast Cancer: Dong-Zhi *et al*., (2006), prepared of recombinant HIV-TATm-Survivin (T34A) protein and its proapoptosis activity was investigated against four cancer cell lines *in*

vitro. The cDNA encoding survivin was cloned by RT-PCR obtained from human breast cancer cell lines, B-Cap37. After the mutation of survivin (T34A) by site-directed mutagenesis, an expression vector of pRSET-B-HIV-TATm-Survivin (T34A) was constructed by PCR. Remarkable effects of the purified recombinant HIVTATm- Survivin (T34A) on the morphology of cell line SW1990 and B-Cap37 were observed after being administrated for 4 h. MTT assay showed that the recombinant HIV-TATm-Survivin (T34A) protein could restrain the cell proliferation of SW1990, B-Cap37, SSMC-7721 *in vitro* [18].

Prostate Cancer: A study conducted by Shigemura *et al*., (2005) antitumor effects of etodolac, a selective cyclooxygenase-II inhibitor, against human prostate cancer cell lines *in vitro* and *in vivo* was evaluated on the three prostate cancer cell lines LNCaP, C4-2, andPC-3 and the results indicated that etodolac exhibited significant antitumor effect *in vivo* and *in vitro* [32].

Human and Canine Bladder Cancer: In a study by Dhawan *et al*. (2009), eight cell lines were established from canine InvTCC. Seven cell lines were found to be tumorigenic in athymic mice, and four of these cell lines grew in an anchorage independent manner. The cell lines expressed several proteins of interest associated with bladder cancer prognosis and progression in humans, including p53, cox-2, and pRb protein [14].

Ovarian Cancer: A study was conducted by Chen *et al*. 2003, to check the inhibition of human cancer cell line growth and human umbilical vein endothelial cell angiogenesis by artemisinin derivatives *in vitro*. The anti-cancer activity was demonstrated by inhibition of four human cancer cell lines: cervical cancer Hela, uterus chorion cancer JAR, embryo transversal cancer RD and ovarian cancer HO-8910 cell lines growth by the MTT assay and the results showed ART and dihydroartemisinin significantly inhibited angiogenisis in a dose-dependent form [27].

Epithelial Carcinoma: In a study by Wen Liu *et al*. (2007), the anticancer activity of eight crude extracts of *Smilax china* L. rhizome (SCR) against HeLa cells was assessed by MTT assay and clonogenic assay, the fraction rich in flavonoids had show good activity against HeLa cells [20].

Salivary Cancer: In a study by Sato *et al*. (1997), emergence of osteoblast-like cells in a neoplastic human salivary cancer cell line (HSGAZA3) after treatment with 22-oxa- la, 25-dihydroxyvitamin D_3 was determined and the result indicated that the emergence of osteoblast-like cells in the human salivary cancer cells occurs in the presence of 22-oxa-la, 25-dihydroxyvitamin D3 and /3-glycerophosphate [25, 26].

Larynx Cancer: In a study by Prasanna *et al*. (2009), anti-cancer effect of *Cassia auriculata* leaf extract *in vitro* through cell cycle arrest and induction of apoptosis in human breast and larynx cancer cell lines MCF-7 (human breast adenocarcinoma cell line), HBL-100 (normal breast cell line), Hep-2, (human epithelial larynx cancer cell line) and Vero (a non-tumorogenic cell line) was determined and the result demonstrated that *Cassia auriculata* leaf extract inhibits the proliferation of MCF-7 and Hep-2 cells through induction of apoptosis [29].

Table 1: Showing various human cancer cell lines

Sr.No.	Cancer Cell Line	Cancerous Part	Reference
1	NSCLC (non-small cell lung cancer) cell lines we used (NCI-H125, H157, -H226, -H358, -H661, MTT	Lung	[11]
2	MCF-7, MDA-MB- 435	Human Breast Cancer Cell Line	[12]
3	PC-3, DU 145 CaP, LN CaP LN 3, BT474	Prostate Cancer	[13]
4	K9TCC-PU-AxA, K9TCC-PU-AxC	Human and Canine Bladder Cancer	[14]
5	PC-3	Prostate Cancer	[15]
6	MDA-MB-468 and ZR-75-1	Mammary	[16]
7	PC-3	Prostatic	[16]
8	SW-1990 and CAPAN-2	Pancreatic	[16]
9	OV-1063	Ovarian	[16]
10	LoVo	Colorectal	[16]
11	HT 29mdr	Human Colon Cancer	[17]
12	B-Cap37	Human Breast Cancer	[18]
13	PK1, CfPAC1, AsPC1	Pancreatic Cancer	[19]
14	BEL-7402	Liver Cancer	[20]
15	HeLa	Cervical Epithelial Carcinoma	[20]
16	95-D cells	High Metastatic Lung Carcinoma	[20]
17	MKN-45	Gastric Cancer Cell	[20]
18	A431	Epithelial Carcinoma	[20]
19	KATOIII cells	Gastric Cancer	[21,22]
20	A549, Y-90 and SPC-A1	Lung Cancer	[23]
21	OAW28,OAW41M, OAW42,OAW59M, 0138D, 0180D and 0253D	Ovarian Cancer	[24]
22	HSGAZA3	Salivary Cancer	[25,26]
23	HO-8910	Ovarian Cancer	[27]
24	LNCaP, C4-2 and PC-3	Prostate Cancer	[28]
25	MCF-7 (human breast adenocarcinoma cell line), HBL-100 (normal breast cell line), Hep-2, (human epithelial larynx cancer cell line) and Vero (a non-tumorogenic cell line)	Larynx Cancer	[29]
26	SK-OV-3 and CAOV-3, RL95–2 and KLE	Gynaecological Cancer	[30]
27	HSC-3, HSC-4, Ca9-22, Ho-1-U-1, Ho-1 N-1and KB	Oral Squamous Cell Carcinoma	[31]
28	LnCap	Prostatic Cancer	[32]
29	MCF-7, SK-BR-3, MDA-MB-231	Ovarian Cancer	[33]
30	AGS	Gastric Cancer	[34]
31	Human SCLC cell lines H69	Lung Cancer	[35]
32	PC-3	Prostate Cancer	[36]
33	HL-60	Human Promyelocytic Leukemia	[37]
34	Colo-205	Colorectal Adenocarcinoma	[37]
35	MCF-7	Breast Cancer	[37]
36	PC-3	Prostate Cancer	[37]
37	MCAS and TYK-Nu	Ovarian Cancer	[38]
38	KIM-1, KYN-1, KYN-2, KYN-3, HAK-1A, HAK-1B, HAK-2, HAK-3, HAK-4, HAK-5 and HAK-6	Liver Cancer	[39]
39	H460, H322, H187, N417	Lung Cancer	[40]
40	GLC-2, GLC-4 and GLC-36	Non-Small Cell Lung Cancer Cell Lines	[40]
41	MCF7 and MDA-MB231	Breast Cancer	[41]

42	NF-103	Skin Fibroblast Cells	[42]
43	Mia PaCa-2	Pancreatic Adenocarcinoma	[43]
44	WiDr	Colon Cancer	[44]
45	PC3, TSU-Pr1, DU145 and LNCaP	Prostate Cancer Cell	[45]
46	SKBr-3, BT-474, MCF7/HER2-18	Breast Cancer	[46]
47	HL-60	Promyelocytic Leukemia	[47]
48	SF295	Brain	[47]
49	KATOIII	Gastric Cancer	[48]
50	MKN28	Gastric Cancer	[48]

Gynaecological Cancer: In a study by Rantanen *et al*. (2002), the correlation between inactivation of the TP53 gene through mutation or the presence of high-risk human papillomavirus (HPV) DNA and intrinsic paclitaxel sensitivity was studied in 27 gynaecological cancer cell lines (SK-OV-3 and CAOV-3, RL95–2, KLE) and the results supported the view that paclitaxel sensitivity of tumour-derived cancer cell lines is not related to the TP53 status [30].

Oral Squamous Cell Carcinoma: In a study by Akira Otsubo *et al*. (2007), *in vitro* antiproliferative effects of UCN-01 on human oral squamous cell carcinoma (OSCC) cell lines (HSC-3, HSC-4, Ca9-22, Ho-1-U-1, Ho-1 N-1, KB) was determined and the findings suggested that UCN-01 induces apoptosis and G1 arrest in OSCCs, albeit with different sensitivity of the primary and metastatic cell lines to UCN-01 [31].

Liver Cancer: In a study by Yano *et al*. (2004), the effect of consensus interferon (IFN-aCon1), a nonnaturally occurring type I interferon with higher specific activity than other type I IFNs, on the growth of human liver cancer cells (KIM-1, KYN-1, KYN-2, KYN-3, HAK-1A, HAK-1B, HAK-2, HAK-3, HAK-4, HAK-5, HAK-6) was determined and the findings suggested that IFN aCon1 expressed a dose-dependent growth inhibitory effect in all cell lines *in vitro* [39].

Brain Cancer: In a study by Oliviera *et al*. (2007), the *in vitro* cytotoxic activity of laticifer proteins (LP) recovered from the latex of the medicinal plant *Calotropis procera* was evaluated and the results suggested that LP is a target for DNA topoisomerase I triggering apoptosis in cancer cell lines (SF295) [47].

Gastric Cancer: In a study by Hosoya *et al*. (1999), the effect of tamoxifen alone and tamoxifen plus 5-Fluorouracil (5-FU) on proliferation of two different types of gastric cancer cell lines (MKN28, KATOIII) using the WST-1 method was investigated suggest that the anti-proliferative effects of tamoxifen plus 5-FU on KATOIII cells were not dependent on estrogen receptor expression or TGF-b1 secretion. On the other hand, their proliferative effects on MKN28 cells might be, in part, caused by the reduced secretion of TGF-b1 [48].

CONCLUSION

From this review it is concluded that cell lines are exceptionally versatile in the types of studies they may be used in. Immortalised cell lines are the *in vitro* equivalent of cancerous cells. Not only can they be build *in vitro* but can also be injected into mice to form xenograft models of prostate cancer progression. They can be transformed and reviewed over time to dispose sequential events that occur as a result of specific stimulus.

REFERENCES

[1] JE Green. *Breast Cancer Res.,* **2003**, 5(1), 1.
[2] N White. *Phil.Trans. R. Soc. Lond. B.* **1999**, 354, 739-749.
[3] Y Hathout. *Expert Rev Proteomics* **2007**, 4, 239-48.
[4] RM Neve et al. *Cancer cell* **2006**, 10, 515-527.
[5] E Boven et al. *Int. J. Cancer* **1997**, 70**,** 335–340.
[6] N Ozturk et al. *PNAS* **2006**, 103, 2178-2183.
[7] A Ghosh; WD Heston. *J Cell Biochem* **2004**, 91, 528-39.
[8] BS Taylor et al. *Mol Cell Proteomics* **2008**, 7, 600-11.
[9] PI Karakiewicz; GC Hutterer. *Nat Clin Pract Urol* **2008**, 5, 82-92.
[10] SF Shariat et al. *J Clin Oncol* **2008**, 26, 1526-31.
[11] J Viallet; MS Tsao; G.Gallant. *Lung cancer* **1996**, 93-101.
[12] XH Liu; JM Connoly; DP Rose. *Cancer letters* **1996**, 223-230.
[13] Y Li et al. *Cancer letters* **2004**, 205, 161–171.
[14] D Dhawan et al. *Urologic Oncology* **2009**, 27, 284–292.
[15] SC Dixon et al. *Cancer Letters* **1997**, 113, 111-116.
[16] V Csernus; AV Schally; K Groot. *Peptides* **1999**, 20, 843–850.
[17] U Valentiner et al. *Toxicology* **2002**, 171, 187–199.
[18] Z Wen-Yun et al. *Chinese Journal of Biotechnology,* **2006**, 22(2), 285–292.
[19] M Miyazawa et al. *Cancer Letters* **2011**, 305, 32–39.
[20] JW Liu et al. *Journal of Ethnopharmacology* **2007**, 113, 115–124.
[21] E Kobayashi et al. Cancer Letters **1999**, 140, 139-143.
[22] S. Marchini et al. *European Journal of Cancer* **2005**, 41, 323–333.
[23] YW Qin et al. *Lung Cancer* **2009**, 66, 169–175.
[24] GA Turner et al. *Cancer Letters* **1995**, 91, 229-234.
[25] M Sato et al. *Cancer Letters* **1997**, 115, 149-160.
[26] SK Singh et al. *Chemico-Biological Interactions* **2008,** 171, 45–56.
[27] HH Chen; HJ Zhou; X Fang. *Pharmacological Research* **2003,** 48, 231–236.
[28] K Shigemura et al. Urology **2005**, 66 (6), 1240-1244.
[29] R Prasanna et al. *Cell Biology International* **2009,** 33, 127-134.
[30] V Rantanen et al. *European Journal of Cancer* **2002,** 38, 1783–1791.
[31] A Otsubo et al. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* **2007**, 103, 391-7.
[32] M Bologna et al. *Urology* **1995**, 45(2), 282-290.
[33] O Treeck et al. Cytokine **2005,** 32, 137-142.
[34] R Iwazaki et al. *Cancer Letters* **1997**, 119, 191-199.
[35] S Matsumoto et al. *Lung Cancer* **2005**, 47, 31-39.
[36] R Jayakumar et al. *Carbohydrate Polymers* **2011,** 84, 407–416.
[37] K Polkowski et al. *Cancer Letters* **2004,** 203, 59–69.
[38] Y Kawakami et al. *European Journal of Cancer* **2000,** 36, 1991-1997.
[39] H Yano et al. *Journal of Hepatology* **2004,** 41, 782–789.
[40] JH Kessler et al. *Cancer Letters* **2007,** 251, 132–145.
[41] JE Dumont et al. *Biochimica et Biophysica Acta* **2009,** 1795, 92–103.
[42] KS Rangappa et al. *European Journal of Medicinal Chemistry* **2009,** 44, 1223–1229.
[43] J Zhou et al. *Current therapeutic research* **2010**, 71(4), 239-251.
[44] M Akutsu et al. *European Journal of Cancer* **1995**, 31A (13-14), 2341-2346.

[45] JP Brussel et al. *Eur J Cancer* **1999**, 35(4), 664-671.
[46] MR Zalutsky et al. Nuclear Medicine and Biology **2006,** 33, 333–347.
[47] JS Oliveira et al. *Toxicology in Vitro* **2007,** 21, 1563–1573.
[48] E Kobayash et al. *Cancer Letters* **1999,** 140, 139-143.