Case Report

It Medical Team
https://www.itmedicalteam.pl/

Archives in Cancer Research
2254-6081

2022
Vol.10 No. 12: 160

Using CRISPR/Cas9 as Precise and High-Through put Genetic Engineering Tools in the Study and Treatment of Gastrointestinal Cancer

Tasmim Bintae*

Department of Genetic Engineering and Biotechnology, University of Dhaka, Dhaka 1000, Bangladesh

Corresponding author: Tasmim Bintae

Tasmimbintae.45@gmail.com

Department of Genetic Engineering and Biotechnology, University of Dhaka, Dhaka 1000, Bangladesh

Citation: Bintae T (2022) Using CRISPR/Cas9 as Precise and High-Through put Genetic Engineering Tools in the Study and Treatment of Gastrointestinal Cancer. Archives Can Res, Vol.10 No. 12: 160.

Abstract

Cancer accounted for pretty much 10 million deaths worldwide in 2020. Metastasis, characterised by neoplastic cell invasion to alternative components of the body, is that the main reason for cancer morbidity and mortality. Therefore, understanding the molecular mechanisms of tumour formation and discovery of potential drug targets square measure of nice importance factor written material techniques are often accustomed realize novel drug targets and study molecular mechanisms. During this review, we have a tendency to describe however common gene-editing ways like CRISPR/Cas9, TALEN and ZFNs work, and, by comparison them, we have a tendency to demonstrate that CRISPR/Cas9 has superior potency and exactness. we have a tendency to more give an outline of the recent applications of CRISPR/Cas9 to cancer analysis, that specialize in the foremost common cancers like carcinoma, carcinoma, body part cancer, and prostatic adenocarcinoma. we have a tendency to describe however these applications can form future analysis and treatment of cancer, and propose new ways in which to beat current challenges.

Keywords: Thyroid cancer; Sarcoma cells of origin; Sarcoma stem cells; Epidemiology; Cell tumour; Radiation therapy

Received: 1-Dec-2022, Manuscript No. ipacr-22-13256; **Editor assigned:** 05-Dec-2022, Preqc No. PQ- ipacr-22-13256; **Reviewed:** 16-Dec-2022, QC No ipacr-22-13256; **Revised:** 23-Dec-2022, Manuscript No. ipacr-22-13256 (R); **Published:** 30-Dec-2022, DOI: 10.36648/2254-6081-10.12-160

Introduction

Modern medication has provided miraculous cures for several human diseases and disorders. Quality of life and lifespan have raised over the past century. Despite these advances there square measure still several challenges to be overcome. One in all these challenges is that the continuous prevalence of cancer. Per GLOBOCAN 2020, there was associate degree incidence of nineteen. 3 million new cancer cases and nearly ten million cancer-related deaths worldwide in 2020. Moreover, though carcinoma still has the very best deathrate, it's been surpassed by carcinoma because the cancer with the foremost new diagnoses [1]. Cancer may be a growth condition characterised by sustained cell growth, invasion, and metastasis among alternative hallmarks. Most of those abnormalities result from specific set of physical mutations. In traditional cells, there square measure restrictive genes that arrest cellular division once genetic defects or abnormal cell size square measure detected. However, in cancer, these restrictive genes lose their function; leading to uncontrolled proliferation. In some instances, genes referred to as proto-oncogenes, that have physiological functions in healthy cells, become mutated, leading to the gain of recent pathological operate [2,3]. These forms of cell reprogramming talents permit cancer cells to form diversifications necessary for survival in an exceedingly dynamic microenvironment while evading growth suppressors though several modes of treatment are introduced within the field of cancer medical aid, together with surgery, radiation therapy, therapy, and new combination therapies, high operative repetition rates aboard radio-resistance and chemo-resistance still be barriers to survival and quality of life factor medical aid has shown outstanding promise in overcoming these obstacles. Thus, it appears that factor medical aid could become one in all the foremost effective ways of cancer treatment.

Gene medical aid is that the manipulation of associate degree individual's ordination, sometimes by introduction of recent genes or knockout of defective genes, to treat a unwellness or disorder. The sphere had its pre-clinical origin within the 1970

s however it took nearly four decades for it to be incorporated into clinical apply. Over those four decades there has been associate degree ever-increasing quantity of analysis and clinical trials. There has additionally been development within the complexness of the therapeutic targets, from the initial treatment of inheritable disorders to the more modern bar and treatment of noninheritable diseases like cancer. The foremost outstanding of those technologies square measure TALEN (Transcription activator-like effector nuclease), ZFN (Zinc Finger Nucleases) and CRISPR (Clustered often Interspaced Short Palindromic Repeats) which permit for precise genetic modifications with sensible potency and high payload delivery. CRISPR/Cas9 specially has opened doors to new genetically changed experimental models, analysis and clinical applications. These nucleases are often designed to acknowledge nearly any sequence.

From its origin, CRISPR has been accustomed study cancer genes by distinctive oncogenes, tumour suppressor genes, and genes that have downstream effects. Thought-about its currently being thought-about for clinical use for cancer treatment because it has established its potency over alternative factor modification tools. the most obstacles to achieving most utilization of CRISPR square measure delivery systems (mainly for in vivo application), high incidence off-target modification, slow performance in factor knock-in, and polymer repair. Despite these obstacles, analysis interest in CRISPR has raised considerably over the past few years. The provision and affordability of CRISPR has resulted within the use of the CRISPR/Cas9 technology in several fields of biology from the creation of experimental models to in vivo applications like factor medical aid. As cancer may be a unwellness characterised by modification, CRISPR/Cas9 is being employed extensively in cancer modeling and development of recent treatments [4].

Discussion

In this review, we have a tendency to gift a comparative summary of the 3 common gene-splicing tools CRISPR, TALEN and ZFN in conjunction with their blessings that square measure relevant to cancer treatment. We have a tendency to additionally describe the numerous applications of CRISPR in numerous aspects of treatment development for breast, lung, liver, prostrate, colorectal, and thyroid cancers still as malignant neoplastic disease and malignant melanoma.

Colorectal cancer is that the third commonest cancer worldwide and also the second most dangerous. Risk factors for body part cancer embody smoking, viscus disease, dangerous nutritive habits, genetic factors, and aging. CRISPR/Cas9-mediated ordination written material has been a useful gizmo within the rummage around for drug targets for treating this fatal unwellness according knockdown of TRIM11 exploitation CRISPR/Cas9 in carcinoma cell lines in vitro, leading to the inhibition of cell proliferation and induction of caspase-mediated cell death. In vivo studies exploitation nude mice advised that silencing this factor additionally reduced tumour growth. NoxO1 knockout by CRISPR/Cas9 mediate ordination written material reduced the anchorage-independent growth on soft agar of carcinoma cells and reduced their ability to make a tumour in vivo. Deleted CBX3 from the HCT116 cell line exploitation CRISPR/Cas9, resulting in cell cycle arrest within the G1 section that ultimately LED to inhibition of proliferation [5]. CXCR4 knockdown exploitation CRISPR/Cas9 failed to cut back the proliferation of the HT115 carcinoma cell line, though it did decrease adhesion to each human vein epithelial tissue cells and extracellular matrix. This means a job of CXCR4 in tumour cell adhesion resulting in body part cancer progression. In vitro studies exploitation the HCT116 cell line incontestable that knockout of PPIP5K resulted in upregulation of p53 and p21 and reduced proliferation and G1/S cell cycle transition.

CRISPR-Cas9-mediated LGR5-CreER knock-in resulted in increased self-renewal and differentiation capability of LGR5+ tumour cells. By selection ablating LGR5+ cancer stem cells (CSCs) in LGR5-iCaspase9 knock-in or ganoids, it had been determined that tumour progression was briefly halted, with progression continued as LGR5+ CSCs re-emerged. ATAT1 knockout exploitation the CRISPR/Cas9 system considerably repressed the proliferative and invasive capacities of HCT116 carcinoma cells it additionally incontestable that loss of αTAT1 slashed Wnt1 expression. Associate degree in vitro and in vivo study disclosed that neoplastic cell growth is often reduced by disrupting the FAPP2 factor exploitation CRISPR/Cas9. CCAT2 knockout in HCT-116 cells in vitro resulted in raised miR-145 expression that negatively regulated miR-21 and slashed each proliferation and differentiation Zhou et al. knocked out caspase-3 in HCT116 cells exploitation CRISPR technology and located that the cells were remarkably less congenic in soft agar assays, less invasive in vitro, and a lot of sensitive to radiation and antibiotic C many in vivo studies had similar outcomes.

The role of ATP-citrate lease (ACLY) within the migration and invasion of carcinoma cells has additionally appraised. ACLY-deficient HCT116 and RKO cell lines designed exploitation CRISPR/Cas9 genome-editing had a reduced ability to migrate and invade. This LED to the conclusion that ACLY interacted with β-catenin and stable it, that promoted the translocation of β-catenin from the protoplasm to nucleus wherever it's transcriptionally active, ultimately resulting in raised migration and invasion of carcinoma cells [6-8]. The roles of CD44 and TLR4 in carcinoma were explored in each in vitro and in vivo study. Fewer tumors were found in mice that were deficient in CD44 or TLR4. CD44- and TLR4-deficient CT26 is grafts had reduced cell proliferation and increased caspase-mediated cell death. Knockout of CD133 exploitation CRISPR-Cas9 in an exceedingly cell line slashed cell proliferation and colony formation, though it failed to totally block the tumor-forming ability of the cell line. A mutation was introduced into TP53 exploitation the CRISPR/Cas9 system in carcinoma cells each loss and abnormal gain of TP53 operate LED to high levels of malignant potential at the late stage of carcinogenesis .

A study explored the correction of the β-catenin mutation carried by HCT116 cells exploitation CRISPR/Cas9; the mutation-corrected cells had reduced growth and made smaller tumors in an exceedingly mouse transplant model. Associate degree in vitro study exploitation the SW480 cell line showed that the factor METTL3 can be a completely unique drug target. Sound out this target exploitation CRISPR-Cas9 technology resulted

in an exceedingly vital inhibition of cell proliferation. Another study was to analyze the correlation of upper with carcinoma. so as to try and do this, they knocked out the PLAUR factor, that encodes the upper macromolecule, exploitation the CRISPR system the expansion rate was reduced, and a big proportion of cells noninheritable a stem-like makeup. In vivo studies employing a mouse model incontestable that upper deletion prevented tumorigenesis. Thyroid cancer is that the most rife fatal unwellness associated with associate degree secretor incidence is increasing thus quick that it's expected to be the fourth most rife cancer by 2030 [9,10].

Conclusion

Thyroid cancer is assessed into four major subtypes: outgrowth thyroid cancer, cyst thyroid cancer, dysplasia thyroid cancer, and medullary thyroid cancer. Outgrowth thyroid cancer is that the most rife, accounting for 80–85% of thyroid cancers. Though the mortality rates for outgrowth thyroid cancer and cyst thyroid cancer square measure low, repetition of the unwellness is considerably high death. This necessitates deeper understanding of molecular mechanisms and discovery of recent drug targets. CRISPR/Cas9 is a good tool to realize each of those aims. A study conducted according that sound out the non-coding RNA nc886 from thyroid neoplastic cell line exploitation the CRISPR/Cas9 genome-editing technique reduced proliferation, migration and invasion of the cells. Similar results were according by Huang et al. once they knocked out EGFR from SW579 cells in vitro, leading to reduced cell growth and pathologic process ability. CRISPR/Cas9 was additionally accustomed knockdown Ku80 within the B-CPAP thyroid neoplastic cell line. This not solely reduced proliferation, invasion and colony formation of the cells however additionally raised caspase-mediated cell death.

Acknowledgement

I would like to thank my professor for his support and encouragement.

Conflict of Interest

The authors declare that there is no Conflict of interest.

References

1 Saro HA, Christopher JG, Russell CR, Kirsten KN (2019) Premature aging in young cancer survivors. J Natl Cancer Inst 111: 226-232.

2 Addie H, Jaya S, Mark AL, Arti H (2020) How cancer therapeutics cause accelerated aging: insights from the hallmarks of aging. J Geriatr Oncol 11: 191-193.

3 Jens HW, Karl FH, Mario PS, Andrea H, Bernd K et al. (2008) Hypertension induces somatic cellular senescence in rats and humans by induction of cell cycle inhibitor p16INK4a. Hypertension 52: 123-129.

4 Julie W, Anna KU, Johannes R, Nichola F, Lauren B et al. (2015) Vascular smooth muscle cell senescence promotes atherosclerosis and features of plaque vulnerability. Circulation 132: 1909-1919.

5 Impreet K, Preety R, Sumati R, Mohsin HB, Priyanka S et al. (2018) Endothelial progenitor cells from aged subjects display decreased expression of sirtuin 1, angiogenic functions, and increased senescence. Cell Biol Int 42: 1212-1220.

6 Thomas K, Chrysiis M, Wolter JM, Daniel SP (2010) The essence of senescence. Genes Dev 24: 2463-2479.

7 Tareq S, Liliya Tyutyunyk M, Graeme FM, Moureq RA, Ajinkya SK, et al. (2019) Tumor cell escape from therapy-induced senescence. Biochem Pharmacol 162: 202-212.

8 Campisi J, Kim SH, Lim CS, Rubio M (2001) Cellular senescence, cancer and aging: the telomere connection. Exp Geronto, 36: 1619-1637.

9 Darren JB, Tobias W, Tamar T, Nathan KL, Bennett GC, et al. (2011) Clearance of p16 Ink4a-positive senescent cells delays ageing-associated disorders. Nature 479: 232-236.

10 Tyler JB, Asef A, Charlton FM, Barbara LS, Deursen MJ, et al. (2018) Clearance of senescent glial cells prevents tau-dependent pathology and cognitive decline. Nature 562: 578-582.