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REVIEW ARTICLE

LncRNA-DANCR: A Key Player in Colorectal Cancer Development and Progression

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Abstract: Colorectal Cancer (CRC) is a significant global health issue, being the third most common cancer worldwide and the second most frequent cause of cancer-related deaths. It occurs when cells in the colon or rectum grow uncontrollably, often developing from precancerous polyps. Genetic predisposition and environmental factors, such as diet and lifestyle, contribute to the disease. Recent research has focused on molecular targeted therapies and non-coding RNAs, particularly long non-coding RNAs (lncRNAs), which play a critical role in regulating CRC development and progression. DANCR interacts with microRNAs, proteins, and mRNAs, influencing gene expression and stability. DANCR functions as a promoter of tumor growth, invasion, metastasis, proliferation, migration, apoptosis, disease progression, and prognosis in various cancers. In CRC, DANCR influences both progression and clinical outcomes. This review aims to comprehensively explore the current knowledge regarding DANCR in CRC, including its molecular characteristics, expression patterns, and involvement in regulatory mechanisms, as well as its potential use as a diagnostic, prognostic, and therapeutic tool.

Keywords: Colorectal cancer, lncRNAs, non-coding RNAs, DANCR, progression, metastasis.

1. INTRODUCTION

Colorectal Cancer (CRC) is a significant global health burden in the field of oncology [1]. It occurs due to the uncontrolled growth of cells in the colon or rectum, which are crucial components of the digestive system [2]. According to the World Health Organization, CRC is the third most common cancer worldwide and the second most frequent cause of cancer-related deaths [3]. Therefore, there is an urgent need to have a profound understanding of the molecular intricacies of this disease [4]. CRC usually develops from polyps, which are precancerous lesions [5]. These polyps can progress to invasive carcinomas [6]. Although genetic predisposition plays a role in CRC susceptibility, environmental factors, such as dietary habits and lifestyle, also significantly contribute to the disease [7]. The symptoms of this disease often develop gradually and include changes in bowel habits, rectal bleeding, and unintended weight loss, which makes early detection and intervention difficult [8]. The canonical adenoma-carcinoma sequence refers to the gradual accumulation of genetic mutations, like APC, KRAS, and TP53, which lead to the progression from benign polyps to malignant tumors [9].

Recently, targeting tumor cell proliferation, metastasis, and angiogenesis using molecular targeted therapies has provided an in-depth understanding of the field of cancer biology [4, 10, 11]. Non-coding RNAs, particularly long non-coding RNAs (lncRNAs),

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have been shown to play a critical role in regulating CRC development and progression [12]. LncRNA DANCR has gained attention in recent years due to its potential impact on CRC [13]. Initially linked to cellular differentiation, it has now been identified as a crucial player in cancer biology. Therefore, this lncRNA has the potential to significantly influence both the progression and clinical outcomes of CRC [14, 15]. The purpose of this review is to provide a comprehensive exploration of the current knowledge of DANCR in CRC. By conducting an in-depth analysis of the existing literature, we aim to clarify the molecular characteristics of DANCR, its expression patterns in normal and cancerous tissues, and its intricate involvement in the complex regulatory mechanisms that govern CRC progression. Furthermore, we examine the potential use of DANCR as a diagnostic, prognostic, and therapeutic tool in CRC in this paper, providing insights into its clinical significance.

2. BIOGENESIS OF DANCR AND ITS FUNCTION IN HEALTH AND DISEASES

DANCR, also known as Anti-differentiation ncRNA (ANCR), Small Nucleolar RNA Host Gene protein 13 (SNHG13), and upregulating transcripts 2 (AGU2), is a lncRNA on chromosome 4 that promotes tumor progression [16]. During the creation of pluripotent human Mesenchymal Stem Cells (hMSCs), the expression of a transcript of unknown function was identified. This transcript was found to be significantly upregulated [17]. It was later recognized as an anti-differentiation non-coding RNA because it helps in maintaining epidermal progenitor cells and preventing differentiation in osteoblasts [18]. Until now, it has been reported that DANCR can attach itself to around 50 miRNAs. Apart from miRNAs, DANCR may also interact with proteins or mRNAs. For example, in hepatocellular carcinoma, DANCR was found to interact with 30UTR of CTNNB1 mRNA, thereby blocking the miRNA site and reversing the CTNNB1 suppression mediated by miRNA [19]. Similarly, in sorafenib-resistant HCC, DANCR stabilized PSMD10 expression by binding to its mRNA and blocking miRNA binding sites [20]. Regarding binding to proteins, it is noteworthy that DANCR can control both protein stability and protein degradation [21]. DANCR has an additional role in epigenetic regulation. A protein known as EZH2, which is a histone methyl transferase of Polycomb Repressive Complex 2 (PRC2), binds to DANCR. The interaction between DANCR and EZH2 leads to the epigenetic silencing of gene transcription of the target gene [22]. Moreover, the regulation of DANCR expression occurs at both epigenetic and transcriptional levels. SALL4 can activate DANCR in gastric cancer cells by binding to its promoter [23]. In addition, DANCR has been identified as a drug target and resveratrol has been shown to inhibit cancer growth via the DANCR/PTEN pathway in nasopharyngeal carcinoma [24]. DANCR upregulates hypoxia-inducible factor-1α, which alleviates hypoxia-induced H9c2 cardiomyocyte damage [25]. DANCR was found to regulate miR-33a-5p/spliced X-box-binding protein 1 (Xbp1s) and reduce damage caused by hypoxia and hypoglycemia on cerebral microvascular endothelial cells [26]. It has been shown in recent studies that DANCR is highly expressed in major types of cancers, and its expression is closely related to clinicopathological characteristics, such as lymphatic metastasis, distant metastasis, and Tumor Node Metastasis (TNM) stage. Current evidence suggests that DANCR is associated with important cellular mechanisms and functions as a promoter of tumor growth and spread, tumor invasion, metastasis, proliferation, migration, apoptosis, disease progression, and prognosis in various cancers [27, 28].

It has been observed that the down-regulation of DANCR expression can enhance cell apoptosis and induce cell cycle arrest in the G1 phase [29]. This implies that DANCR can promote the proliferation of tumor cells by obstructing cell apoptosis and facilitating evasion of growth inhibition. The findings suggest that DANCR plays a crucial role in the growth and development of hepatocellular carcinoma [19]. In endometrial carcinoma, overexpression of DANCR can reduce the inhibitory effect of miR-214 on target mRNAs, which ultimately leads to the inhibition of cell apoptosis and the promotion of cell proliferation [30]. DANCR can enhance the movement of cancerous cells in multiple ways. In nasopharyngeal carcinoma cells, DANCR plays a crucial role in promoting cell mobility by stabilizing hypoxia-inducible factor-1a. Hypoxia-inducible Factor 1 (HIF-1) is a group of transcription factors that can activate various hypoxia-responsive genes in response to a hypoxic environment. These genes can facilitate the metastasis and invasion of cancer cells [31]. DANCR can upregulate MMP16 protein and lead to enhanced motility of pancreatic cancer cells [32]. Tumor angiogenesis is a hallmark of cancer that supplies nutrients and oxygen to cancer cells [33]. DANCR is capable of enhancing the expression of Vascular Endothelial Growth Factor A (VEGF-A) and can facilitate the multiplication and motion of endothelial cells, thereby promoting neovascularization in ovarian cancer cells. Additionally, it can also mediate vascular permeability, which further enhances its role in promoting neovascularization in ovarian cancer cells [34, 35]. Activation of the PI3K/Akt signaling pathway by DANCR can decrease the sensitivity of glioma cells to cisplatin. Additionally, DANCR can facilitate the recruitment of the NF-kB protein to genes associated with drug resistance, leading to increased transcription of these genes [36]. Generally, in many types of cancer, DANCR plays several regulatory roles in the advancement of tumors, indicating that it is a crucial pro-tumor regulator. DANCR, which is usually an oncogenic lncRNA, has been shown to inhibit the proliferation and movement of Renal Carcinoma Cells (RCCs) while promoting apoptosis. However, the precise mechanism behind this remains unknown [36, 37].

Stem-like hepatocellular carcinoma cells showed an overexpression of DANCR, which exhibited an association with CTNNB1. CTNNB1 was found to hinder the repressive function of miR-214, miR-320a,

and miR-199a [19]. DANCR expression was found to be up-regulated in both tumor tissues and plasma samples of patients diagnosed with hepatocellular carcinoma. The plasma level of DANCR could prove to be a valuable biomarker to diagnose hepatocellular carcinoma. The expression of DANCR showed a strong correlation with the invasion of microvascular and liver capsules in patients with hepatocellular carcinoma [38]. Reportedly, there was a significant increase in the expression of DANCR in the tissues of gastric cancer patients. Furthermore, the overexpression of DANCR was found to be closely linked to poor overall survival in gastric cancer patients. Additionally, DANCR overexpression had a notable impact on the proliferation of gastric cancer cells by influencing gene expression programs relevant to cell metabolic and cycle processes [39]. Chen et al. discovered that DANCR could enhance the progression of pancreatic ductal adenocarcinoma. They observed higher expression levels of DANCR in pancreatic ductal adenocarcinoma cell lines and tissues. Upon analyzing the correlation between clinicopathological features and DANCR expression, they found that high expression of DANCR was statistically associated with vascular invasion, advanced T stage, lymph node metastasis, and advanced TNM stage. High expression of DANCR was concluded to be an independent risk factor for poor Overall Survival (OS) and Progression-free Survival (PFS) of pancreatic ductal adenocarcinoma. DANCR promotes the proliferation and metastasis of pancreatic ductal adenocarcinoma cells. Furthermore, it is suggested that the miR-33a-5p/AXL signaling pathway could play a role in mediating the function of DANCR [40]. ANCR is an important player in breast cancer progression and metastasis mainly through decreasing EZH2 stability [41]. Li *et al.* discovered ANCR to play a role in TGF-β1-induced EMT. They found that TGF-β1 could decrease ANCR expression by increasing HDAC3 enrichment at the ANCR promoter region, leading to reduced H3 and H4 acetylation of the ANCR promoter in breast cancer. ANCR could inhibit breast cancer cell migration and metastasis by decreasing RUNX2 both *in vitro* and *in vivo* [42]. DANCR was found to be increased in lung cancer, especially in high-grade lung cancer tissues and aggressive cancer cells. In laboratory studies, the increased expression of DANCR led to enhanced cell growth and the formation of cell clusters. On the other hand, blocking DANCR expression through interference effectively restrained the progression of lung cancer in both laboratory and animal studies. It has been shown that DANCR is overexpressed in lung adenocarcinoma and that inhibiting DANCR expression can reduce tumor cell growth, migration, and invasion, while also increasing cell death [43]. Zhao and colleagues discovered that in bladder cancer, DANCR was significantly upregulated. Furthermore, increased expression of DANCR was positively correlated with higher histological grade and advanced TNM stage. The authors demonstrated that the knockdown of DANCR could inhibit bladder cancer cells' malignant phenotypes and EMT. They also observed that DANCR was mostly present in the cytoplasm and acted as a miRNA sponge to positively regulate the expression of Musashi RNA binding protein 2 (MSI2) by sponging miR-149, which subsequently promoted malignant phenotypes of bladder cancer cells [44]. Functional assays showed that DANCR increased bladder cancer cell migration, invasion, and proliferation *in vitro* and promoted tumor lymph node metastasis and growth *in vivo* [45]. In prostate cancer, the expression of DANCR was higher in cancerous tissues and cells than in normal ones [46]. In addition, it was found that DANCR stimulated the invasion and migration of prostate cancer cells *in vitro*, as well as the metastasis of tumor xenografts in nude mice. The expression of DANCR was inhibited by the androgen-AR signaling pathway. Meanwhile, knocking down DANCR resulted in the upregulation of TIMP2/3. This also caused suppression of invasion and migration by the Androgen Receptor (AR). Furthermore, DANCR knockdown reduced the promotion of invasion and migration in prostate cancer cells by enzalutamide treatment [47]. Liang et al. found that DANCR levels were markedly increased in tissues and cells of patients with cervical cancer and that this was strongly associated with a worse prognosis. Furthermore, suppressing DANCR expression was found to decrease the proliferation, migration, and invasion of cervical cancer cells *in vitro*, suggesting that DANCR acts as an oncogene in cervical cancer [48]. Studies conducted recently have also suggested that DANCR may have a significant impact on various other types of cancer, including but not limited to papillary thyroid cancer, esophageal squamous cell carcinoma, ovarian cancer, and retinoblastoma [49].

3. FUNCTIONAL ROLES OF LNCRNA DANCR IN CRC

DANCR was suppressed by Doxorubicin (Dox) and acted as an important repressor of apoptosis in CRC. DANCR promoted the expression of the oncogenic lncRNA MALAT1 by enhancing its RNA stability to suppress apoptosis (Table **1**). MALAT1 mediated the suppressive function of DANCR on apoptosis. DANCR and MALAT1 interacted with the RNA-binding protein QK, and DANCR regulated the protein level of QK. Moreover, QK modulated the RNA stability of MALAT1, and DANCR controlled the interaction between QK and MALAT1. Additionally, QK could mediate DANCR's function in regulating MALAT1 expression and suppressing apoptosis. These findings shed new light on the function and working mechanism of DANCR in CRC cells [50].

Bahreini et al. performed a case-control study on 40 CRC specimens and 40 adjacent healthy tissues. In patients with low miR-145-5p expression, the risk of dying from CRC was approximately ten times higher than in patients with high expression levels. The risk of dying from CRC can increase up to four times with high expression levels of NRAS. The study found no relationship between CRC death risk and DANCR expression levels. These expression levels showed

Table 1. Functional characterization of *lncRNA DANCR* in CRC.

-	Expression	Role	Functional Role	Refs.
DANCR/ MALAT1	Overexpression	Oncogene	DANCR controlled RNA-binding protein QK expression to enhance the stability of MALAT1; MALAT1 and QK mediated the anti-apoptotic function of DANCR.	[50]
DANCR	Overexpression	Oncogene	Serum DANCR expression was significantly correlated with different TNM stages and CA199, but not with CEA; the AUC of serum DANCR was greater than that of CEA and CA199, and simultaneous detection of DANCR, CEA, and CA199 resulted in the highest sensitivity and AUC as compared with each of them alone.	[52]
DANCR	Overexpression	Oncogene	Tumors with high expression of DANCR were correlated with TNM stage, histologic grade, and lymph node metastasis; patients with high expression of DANCR had a shorter OS and DFS, and DANCR expression was an independent poor prognostic factor for both OS and DFS.	[53]
DANCR	Overexpression	Oncogene	DANCR upregulation was associated with shorter patient survival time; its depletion reduced cell proliferation, cell cycle progression, and tumorigenesis. DANCR bound with lysine acetyltransferase 6A, and this binding turned out to be essential for KAT6A acetyltransferase activity and, thus, it influenced KAT6A target genes expression.	[54]
DANCR	Overexpression	Oncogene	DANCR silencing significantly inhibited the proliferation, invasion, and metastasis of HT-29 cells; the expression of E-cadherin increased significantly and that of vimentin decreased significantly after DANCR silencing. DANCR silencing markedly suppressed CRC growth and metastasis.	[55]
DANCR	Overexpression	Oncogene	Silencing DANCR significantly inhibited cell proliferation and colony formation; apoptosis was induced by DANCR knockdown, and silencing DANCR efficiently impaired colon tumor growth by enhancing caspase-3 expression and tumor apoptosis.	[56]
DANCR/NRAS	Overexpression	Oncogene	According to the DANCR and NRAS's values of specificity and sensitivity, these molecular biomarkers have the potential to be utilized for screening and differentiating CRC patients.	[57]
DANCR/miR-185-5p/HMGA2	Overexpression	Oncogene	High expression of DANCR was significantly associated with increased TNM stage and positive lymph node metastasis; its overexpression promoted CRC cell proliferation, migration, invasion, and cell cycle progression, but inhibited apoptosis. DANCR was identified as a molecular sponge for miR-185-5p, and it could indirectly increase HMGA2 expression via repressing miR-185-5p.	[58]
DANCR/miR-577/HSP27	Overexpression	Oncogene	DANCR correlated with proliferation and metastasis and promoted HSP27 expression and its mediation of proliferation/metastasis via miR-577 sponging.	[59]
DANCR/miR-518a-3p/MDM2	Overexpression	Oncogene	DANCR silencing inhibited CRC cells' growth and metastasis through the DANCR/miR-518a-3p/MDM2 ceRNA network and the following Smad2/3 signaling inactivation.	[60]
DANCR/miR-145-5p/NRAS	Overexpression	Oncogene	DANCR regulated NRAS expression by sponging miR-145-5; the mean expression of miR-145-5p and NRAS was significantly different between tumor and normal tissue, and a significant correlation was observed between DANCR and miR-145-5p, and also between miR-145-5p and NRAS.	[61]
DANCR/miR-125b-5p/HK2	Overexpression	Oncogene	DANCR was upregulated in cisplatin-resistant colon cancer cells; it bound to the miR-125b-5p seeding region. DANCR and miR-125b-5p had a negative correlation, and there was a markedly higher rate of glycolysis in the cisplatin-resistant cells. miR-125b-5p directly targeted the glycolysis enzyme HK2 in colon cancer cells.	[62]

that miRNA-145-5p and NRAS can be used as diagnostic biomarkers for CRC mortality. This could also present microRNAs as potential therapeutic targets for CRC [51].

It was discovered that the CRC tissue and serum had significantly higher DANCR levels and that post-operative patients had lower serum DANCR expression than pre-treatment and recurrent patients did. Furthermore, there was a significant correlation found between serum DANCR expression and different TNM stages. In CRC patients, the serum DANCR expression level was significantly correlated with CA199, but not with CEA. As for diagnostic efficiency by ROC analysis, the Area Under the Curve (AUC) of serum DANCR was greater than that of CEA and CA199 in the CRC group compared to the colorectal polyp group. Simultaneous detection of serum DANCR, CEA, and CA199 could improve the diagnostic efficacy of CRC. All things considered, serum DANCR was found to be elevated in patients with CRC, and elevated DANCR expression could serve as a useful biomarker for CRC diagnosis [52].

An additional investigation revealed that lncRNA DANCR expression was increased in CRC tissues

compared to that in adjacent normal tissues. Moreover, there was a correlation between tumors with high DANCR expression and TNM stage, histologic grade, and lymph node metastasis. Patients with high DANCR expression had shorter Overall Survival (OS) and Disease-free Survival (DFS) compared to the low DANCR expression group. Furthermore, the findings demonstrated that DANCR expression was an independent poor prognostic factor for both OS and DFS in CRC. Based on the findings, lncRNA DANCR expression may be a new potential biomarker for the prognosis of CRC [53].

The lncRNA DANCR was found to be upregulated in CRC in a different study. Patients who had shorter survival times had higher expression of DANCR. DANCR depletion reduced cell proliferation, cell cycle progression, and tumorigenesis. The study also showed that DANCR bound with H3K23 acetyltransferase, KAT6A. This binding was necessary for KAT6A acetyltransferase activity, leading to KAT6A-mediated target gene expression and, subsequently, enhanced CRC cell cycle progression. Consequently, DANCR might be a target molecule for the treatment of CRC [54].

Further study indicated that DANCR expression was significantly higher in CRC tissues and HT-29 cells than in non-CRC tissues and FHC cells. DANCR silencing significantly inhibited HT-29 proliferation, invasion, and metastasis. After silencing DANCR, E-cadherin expression significantly increased and vimentin expression significantly decreased. DANCR silencing markedly suppressed CRC growth and metastasis. The Epithelial-mesenchymal Transition (EMT) process was found to be regulated by DANCR, thus facilitating the growth and metastasis of CRC [55].

It was discovered that all human CRC cell lines overexpressed DANCR. Cell proliferation and colony formation were markedly suppressed by silencing DANCR. In addition, after DANCR was knocked down, apoptosis was induced. It was discovered that silencing DANCR efficiently impaired colon tumor growth by promoting caspase 3 expression and tumor apoptosis. To sum up, the findings of this investigation showed that DANCR may be a potential therapeutic target for colon cancer [56].

Another study evaluated the expression of DANCR and NRAS in CRC patients in Egyptians. Compared to the control group, the levels of gene expression of DANCR and NRAS showed highly statistically significant upregulations. To distinguish the cases group from the control, the best cutoff point for DANCR gene expression was > 1.693. This value exhibited excellent sensitivity and specificity. The Area Under the Curve (AUC) was 0.918 with a high statistically significant value. To distinguish the cases group from the control, the best cutoff point of NRAS gene expression was > 1.094. This value had excellent sensitivity and specificity. The AUC was 0.917 with a high statistically significant value. The research study revealed the potential role of the NRAS and DANCR genes as novel biomarkers for the early prediction of CRC in Egyptians [57].

3.1. DANCR/miR-185-5p/HMGA2

Another study showed that CRC tissues and cell lines had increased DANCR expression and that this high expression was substantially associated with increased TNM stage and positive lymph node metastasis. Overexpressing DANCR increased CRC cell proliferation, migration, invasion, and cell cycle progression, while suppressing apoptosis; DANCR knockdown had the opposite effects. DANCR was also shown to be a molecular sponge for miR-185-5p, and DANCR could indirectly enhance the expression of High Mobility Group A2 (HMGA2) via repressing miR-185-5p. In conclusion, the DANCR/miR-185-5p/HMGA2 axis was involved in CRC progression [58].

3.2. DANCR/miR-577/HSP27

As shown in the study performed by Wang et al., DANCR was highly expressed in CRC tissue and cell lines and it was correlated with proliferation and metastasis. Moreover, they found both DANCR and Heat Shock Protein 27 (HSP27) to be the targets of miR-577 and share the same miR-577 binding site. In addition, DANCR promoted the expression of HSP27 and its ability to mediate proliferation and metastasis via miR-577 sponging. Lastly, they confirmed that overexpression of DANCR promoted CRC tumor growth and liver metastasis *in vivo*. DANCR might provide a new target to treat CRC, as demonstrated in this study [59].

3.3. DANCR/miR-518a-3p/MDM2

In CRC tissues and cell lines, DANCR levels were high, and higher levels were associated with a worse prognosis and shorter survival times. When DANCR was silenced, the proliferation, viability, metastasis, and resistance to death of CRC cells were inhibited. It was discovered that DANCR was sub-localized in the cytoplasmic matrix and that it mediated the expression of Murine Double Minute 2 (MDM2) in CRC cells by sponging miR-518a-3p, which in turn triggered the Smad2/3 signaling and inhibited p53 expression. Also, *in vivo*, tumor formation and metastasis were suppressed by DANCR silencing in CRC cells. These results may provide novel approaches to the prevention and management of CRC [60].

3.4. DANCR/miR-145-5/NRAS

In CRC, Bahreini *et al.* reported upregulation of DANCR expression. DANCR regulated the expression of NRAS by sponging miR-145-5. Moreover, miR-145-5p and NRAS expression levels in tumors were significantly different from those in normal tissues. miR-145-5p and NRAS showed a significant correlation, as well as DANCR and miR-145-5p. Based on the values of sensitivity and specificity of DANCR, miR-145-5p, and NRAS confirmed with ROC curve analysis, these biomarkers could be helpful in screening and

differentiating between tumor and control samples in CRC [61].

3.5. DANCR/miR-125b-5p/HK2

Colon cancer tissues and cells were significantly upregulated in DANCR compared to normal colon tissues and cells, and DANCR was elevated in cisplatin-resistant colon cancer cells. Furthermore, colon cancer cells were markedly desensitized to cisplatin by DANCR overexpression. Conversely, DANCR silencing significantly overrode colon cancer cells' CDDP resistance. As a competitive endogenous RNA, DANCR was predicted to bind to the miR-125b-5p seeding region. DANCR and miR-125b-5p had a negative correlation in the tissues of colon cancer patients, with miR-125b-5p being downregulated in these tissues and cells. Cisplatin-resistant cells were markedly sensitized by miR-125b-5p overexpression. A markedly higher rate of glycolysis in the cisplatin-resistant cells was discovered. miR-125b-5p directly targeted the glycolysis enzyme Hexokinase 2 (HK2) in colon cancer cells. miR-125b-5p overexpression suppressed cellular glycolysis rate and enhanced cisplatin sensitivity by directly targeting the 3′ UTR of HK2. Significantly, silencing endogenous DANCR induced the miR-125b-5p/HK2 axis, suppressing glycolysis and increasing cisplatin sensitivity in colon cancer cells. These processes could be further rescued through miR-125b-5p inhibition in the DANCR-silenced cells. An *in vivo* xenograft mouse model validated DANCR-promoted cisplatin resistance via the miR-125b-5p/HK2 axis [62].

4. FUTURE PERSPECTIVE

Dysregulation of lncRNAs plays a crucial role in regulating various malignant behaviors of cancer cells, ultimately resulting in cancer progression and metastasis. This suggests that developing novel diagnostic methods and therapeutic options targeting lncRNAs could be a new solution in the battle against cancer. It has been shown that DANCR controls a wide range of cellular processes, including proliferation, apoptosis, and EMT. Increased levels of DANCR have also been associated with resistance to anti-cancer agents, such as cisplatin. This suggests that DANCR-targeting therapies could potentially impact the response of cancer cells to a wide array of drugs. DANCR functions as a ceRNA for miRNAs, interacts with mRNAs or proteins, activates signaling pathways, and regulates epigenetic modulations as part of mechanisms that drive the development of tumors. In CRC, DANCR was found to be upregulated and act as an oncogene. Thus, DANCR is regarded as a potent biomarker that can help predict a patient's prognosis in addition to helping to discriminate cancer patients from healthy individuals or those with benign diseases. Furthermore, combining DANCR with other traditional biomarkers might improve diagnostic efficiency. Since serum DANCR was shown to be higher in CRC patients, it potentiates DANCR as a non-invasive marker for cancer detection. More research is needed to fully understand the clinical significance of DANCR in cancer diagnosis and treatment.

CONCLUSION

Research indicates that DANCR plays a vital role in regulating essential cellular processes, including cell proliferation, apoptosis, and EMT. Additionally, it has been linked to resistance against standard cancer treatments, such as cisplatin. The findings underscore DANCR's importance in the development and progression of CRC, especially regarding its role in regulating apoptosis and its potential therapeutic implications. In CRC cells, DANCR acts as a significant repressor of apoptosis, particularly when treated with Dox. Furthermore, higher levels of DANCR have been associated with worse outcomes for CRC patients, correlating with more advanced TNM stages and shorter overall survival rates. This suggests that DANCR is not only crucial to tumor biology, but also serves as a promising biomarker for diagnosing and predicting CRC prognosis. By targeting this lncRNA, we could develop new strategies to combat drug resistance and enhance treatment effectiveness, ultimately leading to improved clinical outcomes for patients battling colorectal cancer.

AUTHORS' CONTRIBUTIONS

All authors have approved the submitted version of the article and have agreed to be personally accountable for the accuracy or integrity of any part of the work. All authors have read and approved the final manuscript.

LIST OF ABBREVIATIONS

RCCs	=	Renal carcinoma cells
VEGF-A	=	Vascular endothelial growth factor A
PRC2	=	Polycomb repressive complex 2
lncRNAs	=	Long non-coding RNAs
CRC	=	Colorectal cancer

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