Predictive values of miR-129 and miR-139 for efficacy on patients with prostate cancer after chemotherapy and prognostic correlation

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Abstract. Predictive values of miR-129 and miR-139 for efficacy on patients with prostate cancer (PC) after chemotherapy and prognostic correlation were explored. Eighty-four patients with PC undergoing chemotherapy in The Third Affiliated Hospital of Qiqihar Medical University from January 2016 to January 2017 were enrolled as the observation group treated with DP regimen, and further 100 healthy individuals undergoing physical examination were enrolled as the control group. RT-qPCR was used to detect expression of serum miR-129 and miR-139. According to the clinical efficacy after treatment, patients with complete remission (CR) and partial remission (PR) were considered as a good curative effect group, whereas those with stable disease (SD) and progressive disease (PD) were considered as a poor curative effect group. In the observation group, miR-129 and miR-139 expression after treatment was significantly lower and higher, respectively, than that before treatment (P<0.05). After treatment, there were 15 patients with CR, 30 with PR, 26 with SD, and 13 with PD in the observation group. Before treatment, compared with the poor curative effect group, patients in the good curative effect group had significantly higher miR-129 expression but significantly lower miR-139 expression (P<0.05). The overall survival rate (OSR) of patients was 64.29%. The survival of patients in the miR-129 high expression group was significantly better than that in the miR-129 low expression group (P=0.001), whereas the survival in the miR-139 low expression group was significantly better than that in the miR-139 high expression group (P=0.012). According to multivariate Cox regression analysis, Gleason score, prostate specific antigen (PSA), bone metastasis, TNM staging, miR-129, and miR-139 were independent prognostic factors affecting patients. In conclusion, miR-129 and miR-139 are expected to be potential indicators for the diagnosis, prognosis, and efficacy prediction of PC.

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Introduction

Prostate cancer (PC) has the second highest incidence in malignant tumors among males (1). A study in 2017 showed that its incidence was second only to that of lung cancer in the United States (2). The incidence in China is lower than that in European and American countries, but it has significantly increased in recent years. According to 2015 cancer statistics in China, the incidence of PC ranked 7th among male tumors, and the disease was the only urinary system tumor in the top 10 (3). Due to the increasing incidence, early diagnosis and treatment of PC is essential and needs to be improved. Currently, the main serological diagnostic marker for PC is serum prostate specific antigen (PSA), which has low specificity and is prone to false positives. Infection, trauma, and prostatic hyperplasia result in an increase in the expression of PSA, which causes patients to undergo prostate needle biopsy for diagnosis (4). Therefore, it is necessary for clinicians and scientific researchers to find new serological diagnostic markers.

As a non-coding short-strand RNA with a length of ~22 nt, microRNA (miR) has been valued by increasing number of scholars in recent years. It binds to the 3'-untranslated regions (3'-UTR) of its downstream target gene mRNA, and inhibits the translation and transcription of the gene, thereby changing the gene expression (5). Studies have proved that miRs are differentially expressed in tumors (6), cardiovascular diseases (7), and genetic diseases (8), involved in their development and progression. miR-129 is a special miR family encoded and synthesized through miR-129-1 and miR-129-2, and miR-129-5p is the embodiment of miR-129 function (9). A study has shown that miR-129 is located around fragile sites at 7q, and loss of the sites is closely related to PC (10). In the study of Catto *et al* (11) miR-129 was differentially expressed in PC and it may be a potential target for the treatment of the disease. However, there are currently few studies on miR-129

in PC. According to a study, miR-139 located on chromosome 11q13.4, inhibits the development and progression of malignant tumors (12). In a study by Amemiya *et al* (13), miR-139 regulates the invasiveness of PC by targeting IGF1R, but whether it can be used as a potential diagnostic and prognostic marker for the disease remains unclear.

Chemotherapy is necessary for patients with intermediate and high risks of cancer. However, there are currently few prognostic indicators for patients with PC, and whether serum miR can be used as a potential one remains unclear. Therefore, the expression of miR-129 and miR-139 before treatment was observed in this study, to determine that whether they can be used as potential predictive indicators for the clinical efficacy on patients with PC, so as to provide references for clinicians.

Patients and methods

Eighty-four male patients with PC undergoing chemotherapy in The Third Affiliated Hospital of Qiqihar Medical University (Qiqihar, China) from January 2016 to January 2017 were enrolled as the observation group, aged 60-75 years with an average age of 65.4±4.3 years. In this study, the patients were mostly those with bone metastases, because bone metastasis is the clinically common type of prostate cancer metastasis (14). Further 100 male healthy individuals underdoing physical examination were enrolled as the control group, aged 55-75 years with an average age of 64.2±5.1 years. The healthy individuals had normal laboratory biochemical indices, blood routine, immune function, PSA testing, and prostate ultrasound, without congenital defects. This study was approved by the Medical Ethics Committee of The Third Affiliated Hospital of Qiqihar Medical University.

Inclusion and exclusion criteria. The inclusion criteria were as follows: Patients were diagnosed with PC by biopsy. Patients had received endocrine therapy. Patients met the 7th edition of TNM staging from AJCC in the United States (15). Patients had a pathological classification of PC with Gleason score as a standard (16) at the time of diagnosis. Patients who had complete clinical data were treated in this hospital. Patients and their families were informed and they signed an informed consent form. All patients were treated with castration and were castration-resistant. Patients without bone metastases were not treated.

The exclusion criteria were as follows: Patients with congenital defects; patients complicated with other tumors; patients who had received other chemotherapy regimens; patients with infection, immune deficiency, neurological dysfunction, severe cardiovascular and cerebrovascular diseases, or liver and kidney diseases.

Detection methods. Fasting venous peripheral blood (5 ml) was extracted from the patients before and after treatment and from the healthy individuals in the morning of the following day. The blood was allowed to stand for 30 min, and centrifuged at 4˚C and 1509.3 x g for 10 min to collect serum, which was subpackaged with enzyme-free EP tubes. Part of the serum was used for this experiment, and the rest was stored at -80˚C. EasyPure miRNA Kit (TransGen Biotech; ER601-01) was used to extract total RNA. UV spectrophotometer (Evolution™ 201 purchased from Thermo Scientific™, Massachusetts Institute of Technology) and agarose gel electrophoresis were used to detect its purity, concentration, and integrity. TransScript Green miRNA Two-Step qRT-PCR SuperMix (TransGen Biotech; AQ202-01) was used to reverse transcribe the total RNA, with the steps carried out according to the kit instructions. cDNA was collected for PCR amplification. The upstream and downstream sequences of miR-129 were 5'-GAT ACTCACTTTTTGCGGTCT-3' and 5'-GTGCAGGGTCCG AGGT-3', respectively; of miR-139 were 5'-CTCTGCTCT ACAGTGCACGTGTC-3' and 5'-TATGGTTGTTCTCGACT CCTTCAC-3', respectively; and of U6 were 5'-CGCTGG CAGCCACATATAC-3' and 5'-CAGGGCATGCATATCTT-3', respectively. The qPCR amplification system was as follows: 1 μl of cDNA, each 0.4 μl of upstream and downstream primers, 10 μl of 2xTransTaq® Tip Green qPCR SuperMix, 0.4 μl of Passive Reference Dye (50X), and ddH_2O to complement to 20 μl. Conditions for the amplification were as follows: pre-denaturation at 94˚C for 30 sec, denaturation at 94˚C for 5 sec, and annealing and extension at 60˚C for 30 sec, for 40 cycles. Three identical wells were provided for each sample, and the experiment was carried out three times. U6 was used as an internal reference and the $2^{-\Delta\Delta cq}$ (17) method was used to analyze the data.

Therapeutic regimen for patients in the observation group. Patients in the observation group were treated with docetaxel (Harbin Laiboten Pharmaceutical Co., Ltd.; SFDA, approval no. H20153308) combined with prednisone (Fuhe Pharmaceutical Group Co., Ltd.; SFDA, approval no. H23020385) (DP regimen) for first-line chemotherapy. They were orally administered with dexamethasone (4.5 mg) every 12 h at 1 day before chemotherapy, at the day of chemotherapy, and on the 1st day after chemotherapy, so as to prevent uroschesis and other adverse reactions. They were intravenously dripped with docetaxel (75 mg/m^2), and orally administered with prednisone (5 mg), twice/day. A total of 21 days was 1 course of treatment. During chemotherapy, the patients were given routine stomach protection (proton pump inhibitors), and symptomatic and supportive treatment. The patients in this study took a 2-week rest after the first course of chemotherapy and then underwent the second course.

Follow-up. Patients were followed up for the overall survival rate (OSR), once every 3 months, from the treatment with DP regimen to the end time of the follow-up (January 1, 2019) or patient non-survival. The patients from 2016 to 2017 were enrolled in this study, and the OSR is the overall survival rate as of 2019.

Response evaluation criteria. The clinical efficacy was evaluated after 2 courses of treatment. The changes of tumor size were calculated based on MRI and CT results, and the efficacy was classified according to Response Evaluation Criteria in Solid Tumor (RECIST) [complete remission (CR), partial remission (PR), stable disease (SD), progressive disease (PD)]. The detection site was the primary tumor.

Observational indexes. Main observational indexes: expression of serum miR-129 and miR-139 between the two groups

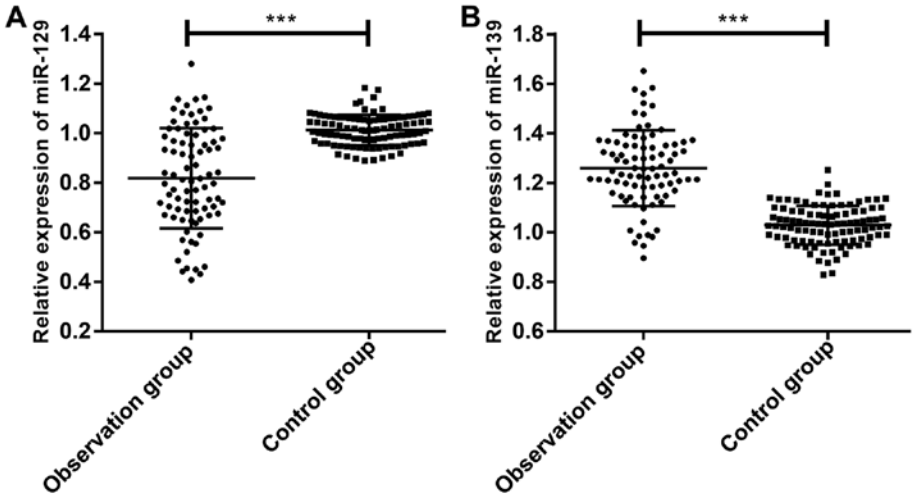

Figure 1. Expression of miR-129 and miR-139 in the control and observation groups. (A) miR-129 expression in the control and observation groups. ***P<0.001. (B) miR-139 expression in the control and observation groups. ***P<0.001.

and the expression in the observation group between before and after treatment was compared. The receiver operating characteristic (ROC) curves were plotted to observe the diagnostic values of miR-129 and miR-139 in PC. According to the clinical efficacy, patients with CR and PR were considered as the good curative effect group, whereas those with SD and PD were considered as the poor curative effect group. Expression miR-129 and miR-139 before treatment between the two groups was compared. Based on the expression before treatment, ROC curves were plotted to observe the predictive values of miR-129 and miR-139.

Secondary observational indexes: The survival curves were plotted based on the survival of patients. The median expression of miR-129 and miR-139 before treatment was used to divide the patients into the high and low expression groups, Kaplan Meier (K-M) survival curves were plotted and Log-rank test was used for analysis. The clinical data of patients in the good and poor curative effect groups were collected for univariate analysis, and multivariate Cox regression analysis was conducted on meaningful indicators to analyze independent prognostic factors affecting patients.

Statistical analysis. In this study, SPSS20.0 (Cabit Information Technology Co., Ltd.) software package was used to statistically analyze the data, and GraphPad Prism 7 (Softhead Inc.) was used to plot figures. Enumeration data were expressed by rate (%), tested by Chi-square and represented by χ^2. K-S test was used to analyze data distribution. Measurement data were expressed by mean ± standard deviation (mean ± SD). The comparison of the data conforming to normal distribution between two groups was analyzed by independent samples t-test, and the comparison within groups was analyzed by paired t-test and represented by t. The comparison of the data not conforming to normal distribution were analyzed by non-parametric test and represented by Z. K-M survival curves were plotted to observe the survival. Log-rank test was used to analyze whether there was a difference in the overall survival. Multivariate Cox regression analysis was used to compare independent prognostic factors affecting the clinical efficacy. P<0.05 indicated a statistically significant difference between two groups.

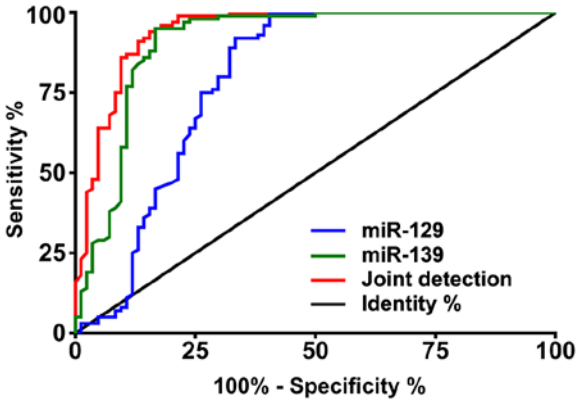

Figure 2. ROC curves of miR-129 and miR-139 in diagnosis of PC. When the cut-off point of miR-129 was 0.881, the best specificity was 59.52% and the best sensitivity was 100.00%. When the cut-off point of miR-139 was 1.141, the best specificity was 95.00% and the best sensitivity was 83.33%. When the cut-off point of the joint detection was 0.480, the best specificity was 94.00% and the best sensitivity was 94.52%. ROC, receiver operating characteristic; PC, prostate cancer.

Results

Comparison of clinical data. There were no statistically significant differences in age, BMI, past medical history, history of smoking, history of alcohol consumption, and place of residence between the observation and control groups (P>0.05) (Table I).

Expression comparison of miR-129 and miR-139. According to the comparison of miR-129 and miR-139 expression, miR-129 expression in the observation group (0.818±0.220) was significantly lower than that in the control group (1.013±0.062) (Fig. 1A), whereas miR-139 expression in the observation group (1.258±0.184) was significantly higher than that in the control group (1.025±0.084) (P<0.05) (Fig. 1B).

Diagnostic values of miR-129 and miR-139 in PC. According to the ROC curves, the area under curve (AUC) of miR-129 was 0.792, 95% CI: 0.718-0.865, that of miR-139 was 0.908,

Table I. Clinical data of patients.

Factors	Observation group (n=84)	Control group (n=100)	$t/\chi^2/Z$ value	P-value
Age (years)				
<65	49 (58.33)	52 (52.00)	0.740	0.390
≥65	35 (41.67)	48 (48.00)		
BMI (kg/m^2)	22.58±1.55	22.84±1.84	1.025	0.307
Past medical history				
Hypertension	19 (22.62)	28 (28.00)	0.630	0.427
Diabetes	10 (11.90)	15 (15.00)	0.373	0.542
History of smoking			0.252	0.616
Yes	70 (83.33)	86 (86.00)		
No	14 (16.67)	14 (14.00)		
History of alcohol consumption			0.153	0.696
Yes	23 (27.38)	30 (30.00)		
No	61 (72.62)	70 (70.00)		
Place of residence			0.393	0.531
Countryside	40 (47.62)	43 (43.00)		
City	44 (52.38)	57 (57.00)		
Gleason score				
<7	15 (17.86)	0 (0.00)		
7	47 (55.95)	0 (0.00)		
>7	22 (26.19)	0 (0.00)		
PSA (ng/ml)				
<10	13 (15.48)	100 (10.00)	135.552	<0.001
10-20	41 (48.81)	0 (0.00)		
>20	30 (35.68)	0 (0.00)		
Bone metastasis				
Yes	35 (41.67)	0 (0.00)		
No	49 (58.33)	0 (0.00)		
TNM staging				
Stage III	51 (60.71)	0 (0.00)		
Stage IV	33 (39.29)	0 (0.00)		

BMI, body mass index; ROC, receiver operating characteristic; PSA, prostate specific antigen.

Table II. ROC-related parameters.

Indicators	AUC	95% CI	Specificity (%)	Sensitivity (%)	Youden index (%)	Cut-off value
miR-129	0.792	0.718-0.865	59.52	100.00	59.52	>0.881
miR-139	0.908	0.858-0.957	83.33	95.00	78.33	<1.141
Joint detection	0.942	0.906-0.978	84.52	94.00	78.52	>0.480

AUC, area under curve; ROC, receiver operating characteristic.

95% CI: 0.858-0.957, and that of joint detection was 0.942, 95% CI: 0.646-0.852 (Table II and Fig. 2).

Expression of miR-129 and miR-139 before and after treatment. According to the comparison of miR-129 and miR-139 expression before and after treatment, miR-129 expression after treatment (0.941±0.120) was significantly higher than that before treatment (0.818±0.220) (P<0.001) (Fig. 3A), while miR-139 expression after treatment (1.121±0.118) was significantly lower than that before treatment (1.258±0.184) (P<0.001) (Fig. 3B).

Table III. ROC-related parameters.

Indicators	AUC	95% CI	Specificity (%)	Sensitivity (%)	Youden index (%)	Cut-off value
miR-129	0.646	0.518-0.773	88.89	51.28	40.17	<0.701
miR-139	0.741	0.636-0.846	66.67	76.92	43.59	>1.233
Joint detection	0.749	0.646-0.852	62.22	79.49	41.71	>0.406

ROC, receiver operating characteristic.

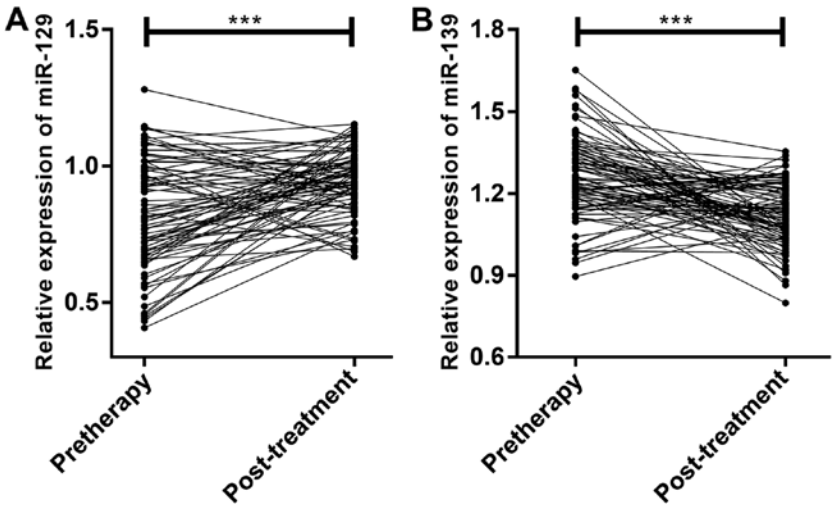

Figure 3. Expression of miR-129 and miR-139 before and after treatment. (A) The relative expression of miR-129 in each patient before and after treatment. ***P<0.001. (B) The relative expression of miR-139 in each patient before and after treatment. ***P<0.001.

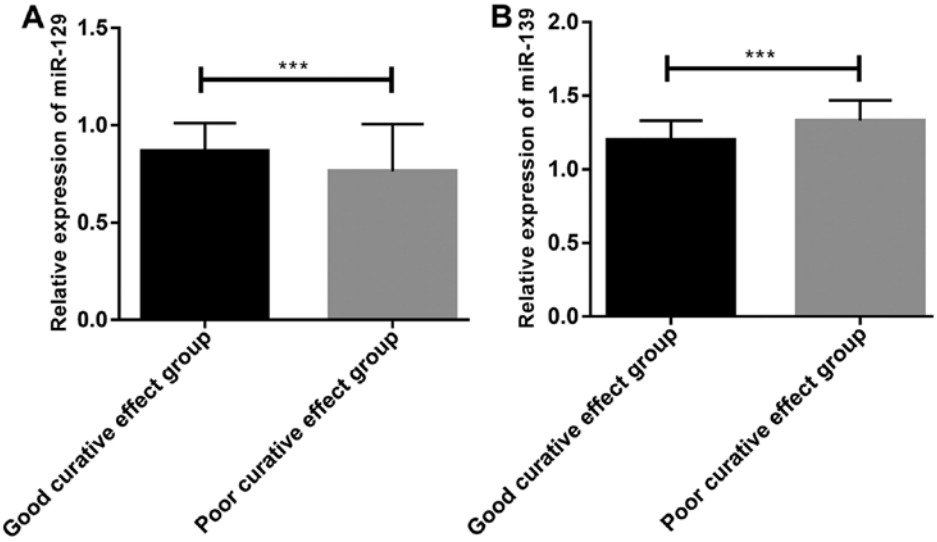

Figure 4. Comparison of miR-129 and miR-139 expression before treatment between good and poor curative effect groups. (A) miR-129 expression before treatment in the good and poor curative effect groups. ***P<0.001. (B) miR-139 expression before treatment in the good and poor curative effect groups. ***P<0.001.

Relationship between expression of miR-129 and miR-139 before treatment and clinical efficacy. According to the evaluation of short-term clinical efficacy based on RECIST, the observation group after treatment consisted of 15 patients with CR, 30 with PR, 26 with SD, and 13 with PD. According to the clinical efficacy, the patients were divided into the good curative effect group (n=45) and the poor curative effect group (n=39). Before treatment, miR-129 expression in the good curative effect group was significantly higher than that in the poor curative effect group (Fig. 4A), whereas miR-139 expression was significantly lower than that in the poor curative effect group (P<0.05) (Fig. 4B).

According to the ROC curves based on expression of miR-129 and miR-139 before treatment, the AUC of miR-129 was 0.646, 95% CI: 0.518-0.773, that of miR-139 was 0.741,

Table IV. Assignment table.

Factors	Assignment
Age	<65 years old, 1; ≥65 years old, 0
BMI	A continuous variable, analyzed with raw data
Hypertension	Yes, 1; no, 0
Diabetes	Yes, 1; no, 0
History of smoking	Yes, 1; no, 0
History of alcohol consumption	Yes, 1; no, 0
Place of residence	Countryside, 1; city, 0
Gleason score	<7, 0; 7, 1; >7, 2
PSA	<10, 0; 10-20, 1; >20, 2
Bone metastasis	Yes, 1; no, 0
TNM staging	Stage III, 1; Stage IV, 0
miR-129	<0.818, 1; ≥0.818, 0
miR-139	<1.259, 1; ≥1.259, 0

BMI, body mass index; PSA, prostate specific antigen.

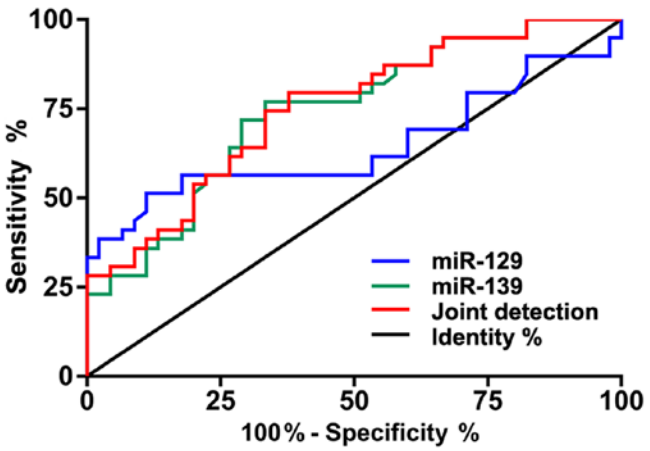

Figure 5. ROC curves of predictive values of miR-129 and miR-139 before treatment for efficacy. When the cut-off point of miR-129 was 0.701, the best specificity was 51.28% and the best sensitivity was 88.89%. When the cut-off point of miR-139 was 1.233, the best specificity was 66.67% and the best sensitivity was 76.92%. When the cut-off point of the joint detection was 0.406, the best specificity was 62.22% and the best sensitivity was 79.49%. ROC, receiver operating characteristic.

95% CI: 0.636-0.846, and that of joint detection was 0.749, 95% CI: 0.906-0.978 (Fig. 5 and Table III).

Relationship between survival and miR-129 and miR-139. According to statistics, all patients in the observation group were followed up, with an OSR of 64.29% (Fig. 6A). According to the median expression of miR-129 and miR-139 before treatment, the patients were divided into the high and low expression groups. The survival in the miR-129 high expression group was significantly better than that in the miR-129 low expression group (P=0.001) (Fig. 6B), whereas the survival in the miR-139 low expression group was significantly better than that in the miR-139 high expression group (P=0.012) (Fig. 6C).

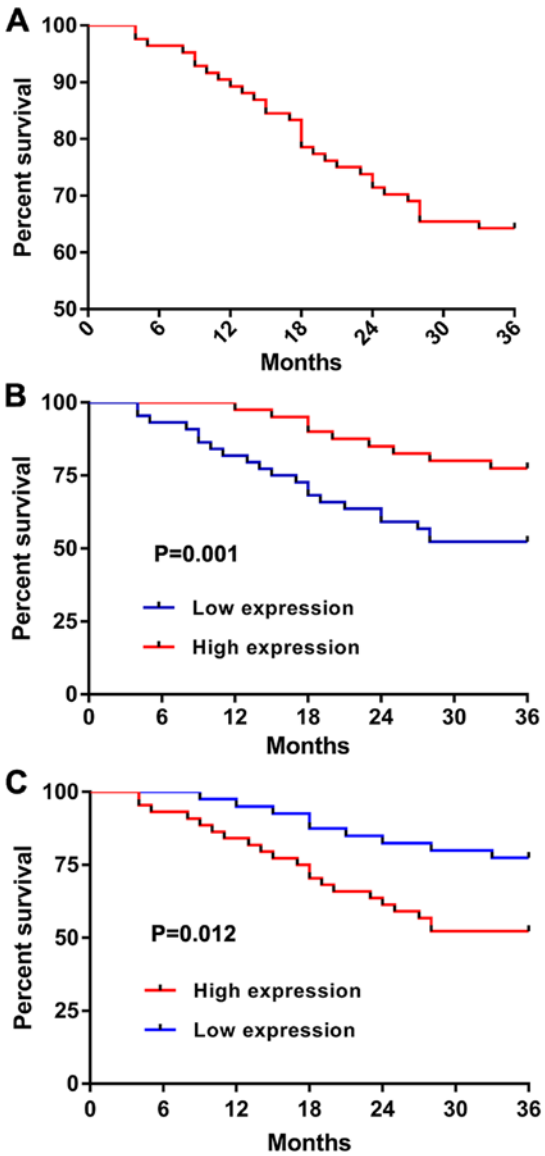

Figure 6. Survival. (A) The OSR of patients. (B) The survival in the miR-129 high expression group was significantly better than that in the miR-129 low expression group (P=0.001). (C) The survival in the miR-139 low expression group was significantly better than that in the miR-139 high expression group (P=0.012). OSR, overall survival rate.

Cox regression analysis. The assignments are shown in Table IV. According to the univariate Cox regression analysis, Gleason score, PSA, bone metastasis, TNM staging, miR-129, and miR-139 were prognostic risk factors affecting patients. According to the multivariate Cox regression analysis, these indicators were independent prognostic factors affecting patients (Tables V and VI).

Discussion

As a malignant tumor that threatens life and health of males, PC has an increasing incidence and mortality around the world. According to Higano (18), among elderly men in New Zealand, Australia, and European and American countries, PC has a high incidence second only to lung cancer and high mortality. The early diagnosis of PC is the main means to improve the patients' survival rate, so it needs to be improved

Table V. Univariate Cox regression analysis.

Factors	B	SE	Wald	Sig.	Exp(B)	95% CI for Exp(B)	
						Lower part	Upper part
Age	-0.114	0.369	0.096	0.757	0.892	0.433	1.837
BMI	-0.052	0.108	0.230	0.631	0.950	0.769	1.172
Hypertension	0.695	0.388	3.205	0.073	2.004	0.936	4.291
Diabetes	0.216	0.537	0.162	0.688	1.241	0.433	3.557
History of smoking	0.261	0.537	0.236	0.627	1.299	0.453	3.721
History of alcohol consumption	-0.819	0.490	2.787	0.095	0.441	0.169	1.153
Place of residence	-0.248	0.369	0.452	0.501	0.781	0.379	1.607
Gleason score	3.022	0.418	52.147	0.000	20.534	9.042	46.634
PSA	2.831	0.532	28.302	0.000	16.968	5.979	48.157
Bone metastasis	1.744	0.414	17.716	0.000	5.721	2.539	12.887
TNM staging	-4.645	1.024	20.564	0.000	0.010	0.001	0.072
miR-129	1.161	0.414	7.882	0.005	3.193	1.420	7.181
miR-139	-2.488	0.610	16.610	0.000	0.083	0.025	0.275

BMI, body mass index; PSA, prostate specific antigen.

Table VI. Multivariate Cox regression analysis.

Factors	B	SE	Wald	Sig.	Exp(B)	95% CI for Exp(B)	
						Lower part	Upper part
Gleason score	1.878	0.51	13.539	0.000	6.537	2.405	17.772
PSA	0.683	0.617	4.329	0.037	1.979	0.591	6.630
Metastasis	1.447	0.515	7.884	0.005	4.248	1.548	11.661
TNM staging	-3.67	1.287	8.126	0.004	0.025	0.002	0.318
miR-129	1.017	0.552	3.654	0.048	2.765	0.937	8.165
miR-139	-1.394	0.672	4.302	0.038	0.248	0.066	0.926

PSA, prostate specific antigen.

urgently. Therefore, it is particularly important to find new serological diagnostic markers.

A current study has shown that miR is closely related to tumors and neurological diseases (19). According to studies, miR-129 and miR-139 belong to the miR family and are differentially expressed in tumors (20,21). Therefore, the diagnostic and prognostic values of miR-129 and miR-139 in PC were explored in this study to provide new serological reference indices for clinicians. Pathological biopsy remains the gold standard of the diagnosis of PC, but we have found that miR-129 and miR-139 have clinical values in the diagnosis and evaluation of the disease.

In this study, serum was collected from the healthy individuals and the patients for detection. Serum samples are easier to collect than tumor solid samples, and they do not cause invasive damage to patients. According to the detection, miR-129 and miR-139 expression in the observation group was significantly lower and higher respectively than that in the control group, which indicates that miR-129 and miR-139 are expected to be potential diagnostic indicators for PC. According to the ROC curves, the AUC of miR-129 was 0.792, that of miR-139 was 0.908, and that of joint detection was 0.942, showing that the joint detection of miR-129 and miR-139 expression can well distinguish patients with PC from healthy individuals, and that miR-129 and miR-139 can be used as potential diagnostic indicators for patients with PC. According to Xu *et al* (22), miR-129 expression in PC mononuclear cells can be used as a biomarker for the diagnosis and prognosis of PC, with an AUC of 0.846. In a study by Pang *et al* (23), the increasing miR-139 expression in peripheral blood could be used as a potential diagnostic indicator for patients with PC, with an AUC of 0.936. The findings of the two studies are consistent with and mutually verify this study. According to the above research, miR-129 and miR-139 can be used as clinical diagnostic indicators for PC, but whether they can be used as potential efficacy prediction indicators for patients with advanced PC has been rarely studied.

Clinically, there are many therapeutic regimens for PC. However, the clinical features of early PC are not apparent,

so the disease has mostly been in its advanced stage after admission of the patients and patients with metastatic lesions have poor survival and prognoses (24). Such patients can only be treated by radiotherapy and chemotherapy. Patients treated with DP regimen, which is the first choice for the treatment of advanced PC, have better prognoses (25). In the present study, patients in the observation group were grouped according to the clinical efficacy after treatment, and the relationship between expression of miR-129 and miR-139 before treatment and efficacy was compared. miR-129 and miR-139 expression in the good curative effect group was higher and lower respectively, than that in the poor curative effect group, suggesting that miR-129 and miR-139 expression before treatment is expected to be potential predictive indicator for clinical efficacy after treatment, with high diagnostic values. According to the median expression of miR-129 and miR-139 before treatment, the patients were divided into the high and low expression groups. In this study, the survival in the miR-129 high expression group was significantly better than that in the miR-129 low expression group, whereas the survival in the miR-139 high and low expression groups was contrary, which indicates the predictive values of miR-129 and miR-139 in the short-term prognosis of patients, and that miR-129 and miR-139 can be used as potential predictive indicators for survival. According to the multivariate Cox regression analysis, Gleason score, PSA, bone metastasis, TNM staging, miR-129, and miR-139 were independent prognostic factors affecting patients. This is consistent with previous findings (26,27), and well illustrates the prognostic values of miR-129 and miR-139 in PC.

In this study, according to the expression detection of miR-129 and miR-139, the differential expression of miR-129 and miR-139 can be used as potential diagnostic indicator for PC, and miR-129 and miR-139 have predictive values for the clinical efficacy after chemotherapy. According to the multivariate Cox regression analysis, miR-129 and miR-139 are independent prognostic indicators affecting patients. However, this study still has limitations. Firstly, miR-129 and miR-139 expression in patients with benign prostatic hyperplasia was not detected. Secondly, due to the short duration of this study, patients were not followed up for a long time. Finally, the cause of the differential expression of miR-129 and miR-139 remains unclear. Therefore, the mechanism between miR-129, miR-139 and PC as well as the expression of miR-129 and miR-139 in patients with prostatitis or prostatic hyperplasia detected, need to be further explored so as to verify the results of this study.

In conclusion, miR-129 and miR-139 are expected to be potential indicators for the diagnosis, prognosis and efficacy prediction of PC.

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Availability of data and materials

The datasets used and/or analyzed during the present study are available from the corresponding author on reasonable request.

Authors' contributions

ZH wrote the manuscript. JG and MZ analyzed and interpreted the patient general data. ZH and TJ performed PCR. XY was responsible for analysis of the observation indicators. All the authors read and approved the final manuscript.

Ethics approval and consent to participate

The study was approved by the Medical Ethics Committee of The Third Affiliated Hospital of Qiqihar Medical University (Qiqihar, China). Patients who participated in this study, had complete clinical data. Signed informed consents were obtained from the patients or the guardians.

Patient consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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