Data S1. *Main experimental reagents*.

Reagent	Manufacturer	Cat. no.
Diethyl pyrocarbonate	Amresco, LLC	E174
4% paraformaldehyde	Wuhan Servicebio Technology Co., Ltd.	G1113
Paraffin	Beijing Solarbio Science & Technology Co., Ltd.	YA0012
Absolute ethanol	Sinopharm Chemical Reagent Co., Ltd.	10009218
Xylene	Sinopharm Chemical Reagent Co., Ltd.	10023418
PBS buffer	Wuhan Servicebio Technology Co., Ltd.	G0020
20X saline sodium citrate eluent	Wuhan Servicebio Technology Co., Ltd.	G3016-4
BSA	Wuhan Servicebio Technology Co., Ltd.	G5001
Protease K	Wuhan Servicebio Technology Co., Ltd.	G1205
DAPI	Wuhan Servicebio Technology Co., Ltd.	G1012
Anti-fluorescence quenching mounting tablets	Wuhan Servicebio Technology Co., Ltd.	G1401
Hybridization buffer	Wuhan Servicebio Technology Co., Ltd.	G3016-3

Fluorescence in situ hybridization on paraffin sections. Tissues were fixed using 4% paraformaldehyde for 1-2 h at room temperature, then dehydrated using a gradient alcohol series and embedded into paraffin. The paraffin sections were cut into 4-μm-thick slices using a slicer and heated at 62˚C for 2 h. The slices were immersed into xylene I for 15 min, xylene II for 15 min, anhydrous ethanol I for 5 min and anhydrous ethanol II for 5 min in sequence, dried naturally and soaked in diethyl pyrocarbonate water. The slices were boiled for 5 min in the repair buffer and cooled naturally. Sections were then digested using proteinase K (20 μg/ml) at 37˚C for 25 min, rinsed with pure water and washed with PBS 3 times for 5 min. The prehybridization solution was added drop by drop and incubated at 37˚C for 1 h. The prehybridization solution was removed, and the hybridization solution containing the microRNA-1236 probe (5'-FAM-CTGGAGAGACAAGGGGAAGAGG-3') was added, with a concentration of 8 ng/Ul, and left overnight at 37˚C in an incubator. The hybridization solution was washed with 2X SSC at 37˚C for 10 min, 1X SSC at 37˚C for 5 min (twice) and 0.5X SSC for 10 min at room temperature. The probe labelled with FAM was directly detected without using antibodies. The slices were stained with DAPI in the dark for 8 min at room temperature and then rinsed with anti-fluorescence quenching sealing tablets. The images were observed under a Nikon positive fluorescence microscope (Nikon Corporation) with the excitation wavelength of FAM (488) green light at 465-495 nm.

Immunohistochemistry (IHC) on paraffin sections. Tissues were fixed using 4% paraformaldehyde for >24 h at room temperature. Tissues were dehydrated using a gradient alcohol series: 75% alcohol for 4 h, 85% alcohol for 2 h, 90% alcohol for 2 h, 95% alcohol for 1 h, anhydrous ethanol I for 30 min, anhydrous ethanol II for 30 min, alcohol benzene for 5-10 min, xylene I for 5-10 min, xylene II for 5-10 min, Wax I for 1 h, Wax II for 1 h and Wax III for 1 h. The tissues soaked in wax were embedded into paraffin in the embedding machine. Sections were cut into 4-μm-thick slices. For IHC, the slices were heated at 60˚C and then rehydrated using xylene I for 8 min, xylene II for 8 min, xylene III for 8 min, anhydrous ethanol I for 5 min, anhydrous ethanol II for 5 min, 85% alcohol for 5 min, 75% alcohol for 5 min and finally washed with tap water for 2 min. The tissue sections were placed in citric acid antigen repair buffer (pH 6.0) in a microwave oven for antigen retrieval at medium heat for 8 min until boiling and left for 8 min, then at medium and low heat for 7 min. After natural cooling, the slides were washed with PBS (pH 7.4) for 3 times (5 min each). Subsequently, the slides were incubated with 3% hydrogen peroxide included in the histochemistry kit (cat. no. I20012C; Hangzhou Bailing Biological Technology Co., Ltd.), and each section was incubated with 50-100 μl for 10 min at room temperature. The slides were washed with PBS (pH 7.4) for 3 times (5 min each). Sections were blocked using 3% BSA at room temperature for 30 min. Subsequently, primary antibodies were prepared in PBS and added to the sections overnight at 4˚C. The slides were washed with PBS (pH 7.4) for 3 times (5 min each) and then covered with universal secondary antibodies (HRP-labeled) included in the aforementioned histochemistry kit and incubated at room temperature for 30 min. The slides were washed with PBS (pH 7.4) for 3 times (5 min each). DAB color developing solution was added after the sections were slightly shaken and dried. The color developing time was controlled under the microscope, and the positive color was brownish-yellow. The color developing was stopped after the sections were washed with pure water. The slices were immersed in 75% alcohol for 5 min, 85% alcohol for 5 min, dehydrated alcohol I for 5 min, anhydrous alcohol II for 5 min and xylene I for 5 min. The slices were taken out of xylene, dried slightly and sealed with neutral gum. Finally, the slices were observed under a light microscope (magnification, x100; Nikon Eclipse E100; Nikon Corporation).

Table SI. Records of tumor size in tumor xenograft model.

Time after cell injection, days	Tumor sizes (long and short diameter, mm)	
	miR-1236-3p sponge	vector
0	(0, 0)	(0, 0)
	(0, 0)	(0, 0)
	(0, 0)	(0, 0)
	(0, 0)	(0, 0)
7	(7.7, 4.1)	(0, 0)
	(7.2, 5.2)	(4.4, 2.8)
	(6.9, 4.5)	(4.6, 3.0)
	(6.5, 5.2)	(3.5, 3.2)
14	(8.1, 7.2)	(4.9, 3.3)
	(8.6, 7.3)	(5.2, 3.6)
	(10.3, 7.1)	(3.7, 3.2)
	(7.5, 6.1)	(2.8, 1.7)
21	(9.0, 8.1)	(6.0, 5.3)
	(11.6, 7.9)	(5.5, 5.4)
	(10.0, 8.2)	(4.5, 4.1)
	(8.2, 6.8)	(3.7, 3.1)
28	(11.5, 8.6)	(7.0, 5.6)
	(12.4, 8.7)	(6.6, 6.0)
	(12.9, 8.9)	(4.6, 4.2)
	(10.4, 7.1)	(4.4, 3.7)
35	(18.5, 9.4)	(10.0, 5.6)
	(16.4, 9.4)	(7.5, 6.1)
	(14.2, 8.8)	(4.8, 4.6)
	(10.6, 7.2)	(4.3, 4.0)

The tumor sizes (long and short diameter, mm) for each tumor in each nude mouse were measured throughout the experiment in the miR-1236-3p sponge and vector negative control groups. miR, microRNA.