22ND WCBIP/WCBE WORLD CONGRESS
Interventional pulmonology in a globalized world
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MARSEILLE, FRANCE
OCTOBER 6-9, 2022

Therapeutic effect and mechanism of bronchoscopic cryoablation on airway stenosis caused by tracheal cartilage injury in rabbits

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Purpose
To establish a rabbit model of tracheal chondrocyte injury, and to observe the therapeutic effect of cryoablation on cartilage injury-induced airway stenosis by EB-OCT analysis under bronchoscopy.
Methods
A rabbit model of tracheal chondrocyte injury was established and identified. Collagenase type (coll-II), matrix metalloproteinase 1 (MMP-1), and matrix metalloproteinase 13 (MMP- 13) mRNA expression and trend of matrix metalloproteinase inhibitor 1 (TIMP-1). Bronchoscopy and EB-OCT image features were observed in animals at 2, 4, and 6 weeks after operation.
Results
Rabbit tracheal chondrocytes were successfully cultured to establish a cell injury model. The gray value of MMP-1 and MMP13 in the freezing group and injury group increased after modeling, and the gray value of COL-II decreased. After injury, the values of MMP-1 and MMP13 in the freezing group increased first and then decreased, and the COL-II decreased and then increased, and the differences were statistically significant. After injury, the apoptosis rate of cryoablation group was significantly lower than that of injury group, and the difference was statistically significant.

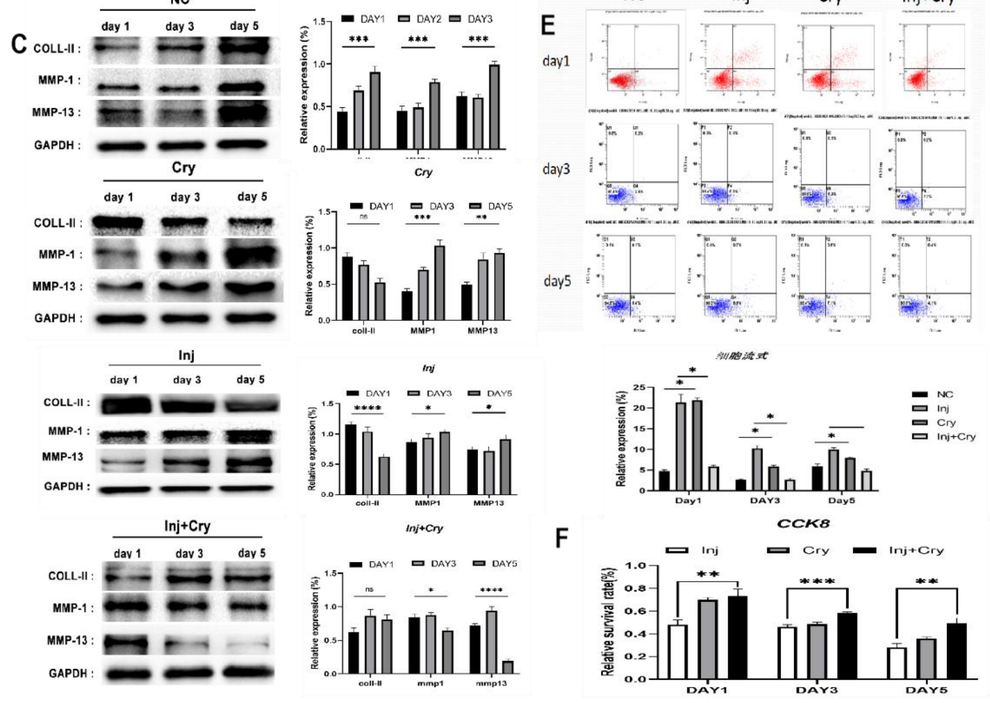

Figure 2 A: The cell growth status of the frozen group, the injury group, and the frozen group after injury on the 1st day, the 3rd day, and the 5th day, respectively. B: Comparison of MMP-1, MMP-13 and COL-II Western blot detection results of tracheal chondrocytes in each group on day1, day3, and day5. C: RNA changes of MMP-1, MMP-13, TIMP-1, and COLL-II in each group of cells on day1, day3, and day5. D: Chondrocyte coll-II, MMP1, MMP13 day 1, day 3, day 5, WB changes. E: Flow cytometric apoptosis detection results of cells in four groups on day1, day3, and day5, respectively. F: CCK8 cell proliferation detection results in each group.

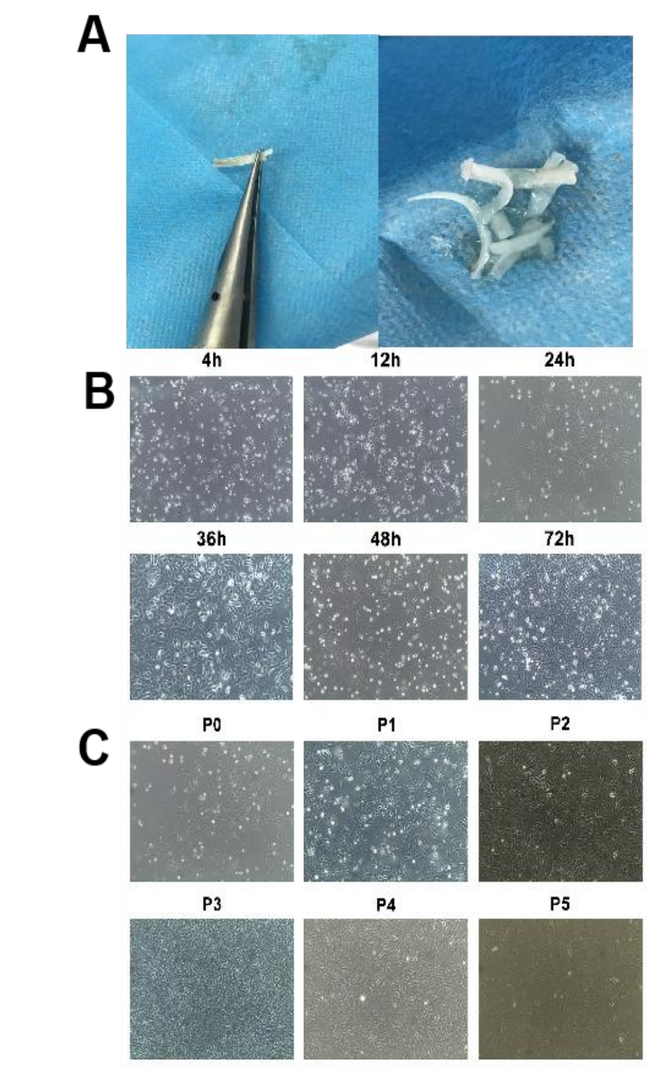

Figure 1A: Aseptic surgery to obtain tracheal tissue and strip cartilage tissue. B: Chondrocyte culture time period: 4, 12, 24, 36, 48, and 72 hours of tracheal chondrocyte survival in the culture dish after primary cell extraction observed under an inverted microscope (×200). C: chondrocyte passage: state changes after tracheal chondrocytes adhered (inverted microscope, ×200). D: Type II collagen immunofluorescence staining results: Type II collagen immunofluorescence staining (from left to right are DAPI fluorescence staining, collagen II immunofluorescence, combined net) × 400. E: Identification of proteoglycans in rabbit tracheal chondrocytes of passages 1-5 (toluidine blue staining, ×200)..

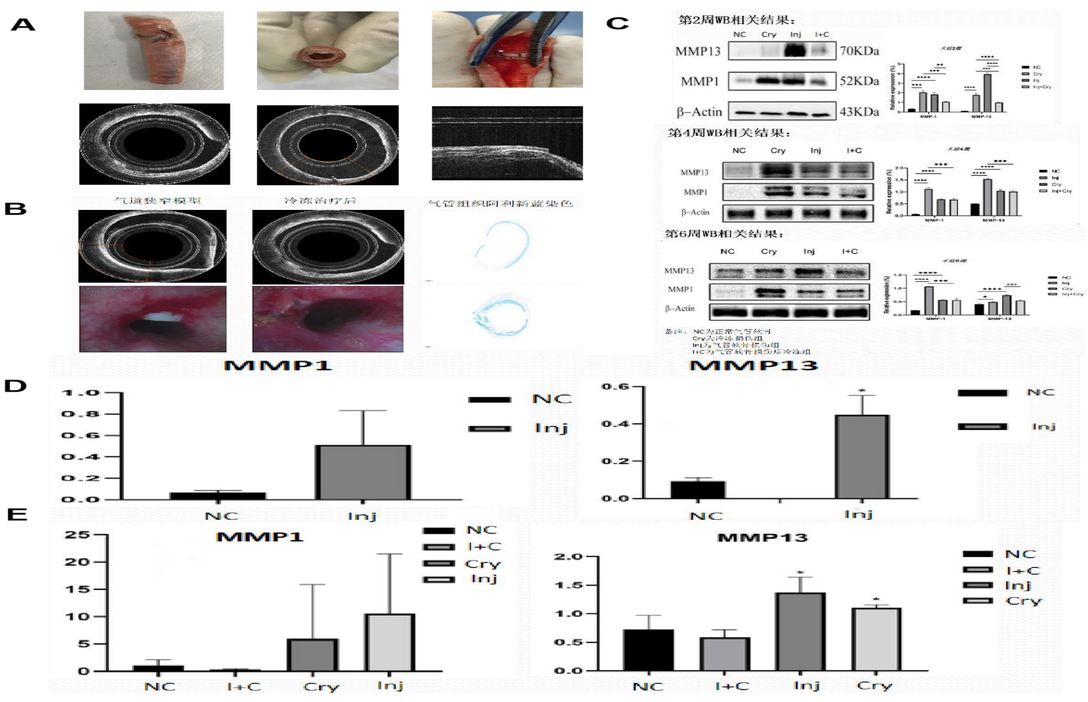

Figure 3 A: Modeled anatomy of the tracheal stenosis. B: Airway stenosis model and images under bronchoscopy and EB-OCT after cryotherapy, respectively. C: In the 2nd, 4th, and 6th weeks, the WB test results and statistical chart results of the four experimental groups. D: Real-time fluorescent PCR detection showed the results of MMP-1 and MMP-13 gene RNA expression. E: Real-time PCR detection results of four groups

Conclusions

The injured tracheal chondrocytes had higher expression of MMP-1 and MMP-13, and lower expression of COL-II. Cryotherapy of injured tracheal chondrocytes has a certain therapeutic effect on injured chondrocytes by inhibiting the expression of MMP-1 and MMP-13, increasing the expression of COL-II, and reducing apoptosis.

Conflicts of Interest

None of the authors have potential conflflicts of interest to declare.