Jellyfish mucin may have potential disease modifying effects of osteoarthritis of the Knee

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Purpose:
We aimed to study the effects of the intra-articular injection of jellyfish mucin (qnimucin) on articular cartilage degeneration in a model of osteoarthritis (OA) created in rabbit knee by the resection of anterior cruciate ligament.

Methods:
Qnimucin was extracted from Aurelia aurita (moon jellyfish) and Stomolophus nomurai (Nomura’s jellyfish) (Fig.1) and purified by ion exchange chromatography. The OA model used 36 knees in 18 Japanese white rabbits. Purified qnimucin extracts from S. nomurai or A. aurita were used at 1 mg/ml. The rabbits were divided into four groups: a control (C) group (injected saline), a hyaluronic acid (HA) only group (H group), two qnimucin only group (M groups) and two qnimucin + HA groups (MH groups). One milligram of each solution was injected intra-articularly once a week for five consecutive weeks, starting from four weeks after surgery. Ten weeks after surgery, the articular cartilage was evaluated macroscopically and histologically (Fig. 2).

Results:
In the C and M groups, macroscopic cartilage defects extended to the subchondral bone on the medial and lateral sides. When the H and both MH groups were compared, only minor cartilage degeneration was observed in the groups treated with qnimucin in contrast to the group without qnimucin (Fig. 3). Histologically, densely safranin-O-stained cartilage layers were observed in the H and two MH groups, but the cartilage was strongly maintained in both MH groups (Fig. 4). The average OA scores were: group C, 22.00 ± 4.00; group H, 11.17 ± 4.65; group M1, 18.67 ± 1.15; group M2, 18.00 ± 0.00; group MH1, 4.33 ± 4.16 and group MH2, 7.00 ± 2.65. Groups C, M1 and M2 did not differ significantly. Significant differences were observed between groups H and C, between groups H and M1 or M2, between groups H and MH1, and between groups M1 or M2 and groups MH1 or MH2 (*P < 0.05) (Fig. 5).

Conclusions:
At the concentrations of qnimucin used in this study, its injection together with HA inhibited articular cartilage degeneration in this model of OA.

Fig. 1 a Nomura’s Jellyfish (BW max 200kg)

Fig. 2 Experimental design

Fig. 3 Macroscopic findings in the femur of the knee joint at week 10 after the preparation of the OA model.

Fig. 4 Histological findings. After the femoral condyle in the knee joint had been resected, it was fixed in 4% neutral-buffered formalin (pH 7.4). It was then decalcified with 10% EDTA and the cross section was embedded in paraffin wax and dewaxed sections were processed for safranin-O (a–f) and toluidine blue (g–l) staining.

Fig. 5 Osteoarthritis score.

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