Cardiac – respiratory response to acoustic noise in the beluga

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The non-auditory effect of noise on marine mammals has been received little attention. The aim of this study was to examine the effect of loud acoustic noise on the heart rate (HR) and the breathing pattern in the beluga. The subject was a 2-3 year old captive beluga male. Electrocardiogram was recorded using suction-cup disk electrodes. The acoustic stimuli (octave band fatiguing noise) ranged between 19 and 108 kHz, overlapping the range of best hearing for the beluga, and lasted 1, 3 and 10 min. The level of noise was 140, 150 and 160 dB. The exposure occurred 1-6 times per session, a total of 20 experimental sessions, each session lasted 3-5 hrs. Acoustic noise evoked cardiac acceleration (tachycardia) with instantaneous HR exceeding 200% of the baseline level. The degree and duration of tachycardia depended both on the frequency and level of noise. The cardiac response was maximal at the frequencies of 19-27 kHz (the instantaneous HR averaged 160-180% of the baseline during the first 4 min of the exposure) and progressively declined when the frequency increased up to 108 kHz (on average < 140% of baseline during the first min of exposure). At the same time, the cardiac response was enhanced when the level of noise was increased from 140 to 150 dB (on average 123 and 167% of baseline, respectively) and did not change when the intensity rose up to 160 dB (168%). The breathing became more frequent during the noise exposure but these changes lasted less than 1 min. To summarize, 1) the response to fatigue acoustic noise in the beluga represented classic cardiovascular defense reaction accompanied by sympathetic activation and parasympathetic inhibition; 2) the HR can be used as a measure of physiological response to fatiguing acoustic noise in the beluga.

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