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**Muscle strength and cardiorespiratory fitness in pancreatic cancer patients – Effects of a 6-month resistance training -**

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Evidently, structured exercise does play an essential role in the supportive cancer therapy. It has been shown that aerobic exercise, as well as resistance training (RT), did lead to improvements in cardiorespiratory fitness and muscle strength in patients with various cancer entities and thus help to counter disease- and treatment-related side effects. Improvements of psychological side effects like fatigue and quality of life can also be achieved with structured exercises. For pancreatic cancer in particular, a fast growing and very aggressive disease with limited prognosis of survival, the maintenance of muscle mass, as well as body weight, and improvements in muscle strength are very important factors in the supportive cancer therapy. RT evidently has the ability to improve muscle strength and to increase muscle mass. However, there has not yet been an intervention trial that analyzed the effects of a structured RT in pancreatic cancer patients. Therefore, this study represents the first randomized controlled intervention study in pancreatic cancer patients that assesses the feasibility and efficacy of a structured six-month progressive RT on physical fitness, both during and after chemotherapy. Two types of RT were compared against each other: A supervised RT on weight machines versus a home-based RT without supervision, but with predefined exercises based on own body weight, resistance bands or dumbbells. Both exercise groups were supposed to perform RT two times per week. A usual care group served as control group to evaluate and compare results. The primary goal of this study was to examine improvements in muscle strength and cardiorespiratory fitness in pancreatic cancer patients. Out of 304 eligible pancreatic cancer

patients, 65 were included in the three-arm trial. In total, 43 patients completed the physical fitness assessments at the end of the six-month intervention period.

First, muscle strength and cardiorespiratory fitness of pancreatic cancer patients before the intervention phase were assessed using gold standard assessments. The findings revealed that the assessed physical fitness level of those patients was reduced compared to age- and gender-specific reference values assessed of healthy individuals.

Second, the overall feasibility for pancreatic cancer patients to perform and complete a structured six-month progressive RT program was evaluated. With an adherence rate of 59.2%, the overall feasibility was given. The patients were able to perform the progressive RT once or twice a week, both during and after chemotherapy. Training adherence tended to be higher in the home-based RT group with 1.6 training sessions per week than in the supervised RT training group with 1.3 training sessions per week.

Finally, this study considered the effects of the RT program on both muscle strength as well as cardiorespiratory fitness. Significant improvements in muscle strength have been observed in several muscle groups of the upper (+12.6%) and the lower extremities (+12.8%). The observed gain in muscle strength was higher in the supervised RT group than in the home-based RT group. This suggests that the performed RT on weight machines under supervision might be better suited to improve muscle strength. The results did not clearly show that RT leads to an increase in muscle mass. Given the importance of maintaining or improving body weight, muscle mass and muscle strength in the supportive therapy of pancreatic cancer, future studies should additionally assess whether RT does increase muscle mass of the patients and therefore counteracts against cachexia, a very common symptom amongst pancreatic cancer patients.

The presented findings indicate that RT is feasible in pancreatic cancer patients during as well as after chemotherapy. It has also been shown that the implemented RT improves muscle strength of the patients. Therefore, RT should be integrated in the supportive therapy management of pancreatic cancer patients and, as feasibility during chemotherapy treatment could be shown, should start as early as possible during the treatment process.