

Horse riding as an atypical type of rehabilitation to improve physical capacity in a patient after cardiac surgeries and before liver transplantation

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End-stage liver failure, regardless of etiology, is a progressive and fatal disease characterized by the loss of liver function which affects other organs [1]. Cardiopulmonary Exercise Testing attracts great interest as a functional test used for assessing the risk before liver transplantation (LTx). It may be helpful to predict mortality, morbidity and length of hospitalization after a non-cardiac procedure [2]. Horse riding is a non-standard physical activity in patients before LTx and after cardiac surgeries. It aims to improve motor functions, body posture, and stamina [3].

A 58-year-old male patient with a history of liver cirrhosis and other co-morbidities was admitted for surgery for a brachycephalic trunk aneurysm. A graft was used to create an anastomosis between the ascending aorta and the right common carotid artery (CCA), and an anastomosis with the distal segment of the brachycephalic trunk was performed. Postoperative complications occurred: respiratory and renal failure, paroxysmal atrial fibrillation, and a worsening of the hepatic function.

Over time, the patient was admitted to the hospital due to moderately severe condition with symptoms of hepatic encephalopathy, jaundice, and ascites. LTx was considered due to end-stage liver disease. Computed tomography angiography showed an aneurysm-like bulge, adjacent to the origin of the left CCA (Figure 1A). It could have been a false aneurysm or the stump of the aneurysm resected earlier. A hybrid procedure based on the implantation of a stent graft into the aortic arch covering the brachyce-

phalic trunk and the left CCA and a right to left carotid-carotid bypass graft (Figure 1B). Qualification for LTx was postponed. Four months later spirometry revealed pulmonary obturation. Cardiopulmonary Exercise Testing demonstrated exercise oscillation of ventilation and ventilatory obstruction (Figure 1C and 1E), reduced exercise capacity with peak oxygen uptake (VO_{2peak}) 18.9 ml/kg/min and oxygen uptake at anaerobic threshold (AT) 11.2 ml/kg/min (Figure 1G). The 6-minute walk test was aborted at 5.5 METS due to the patient's fatigue. Additionally, complex exertion-induced ventricular arrhythmia was diagnosed. Qualification for LTx was delayed for further 4 months, and pharmacological treatment was initiated: beta-adrenolytics and bronchodilators. At the next qualification attempt, persistent pulmonary obturation and decreased physical capacity were noted, and LTx was postponed for further 2 months. After that time, without any new pharmacotherapy, the patient demonstrated an improved physical capacity compared with previous exams: better profile of ventilation (Figure 1D and 1F), improved VO_{2peak} of 21.9 ml/kg/min, AT of 14.2 ml/kg/min (Figure 1H), and the 6-minute walk test with 6.3 METS. No significant heart rhythm disturbances were observed. It turned out that the patient had taken up horse riding as his new hobby and rehabilitation, which improved his physical performance and allowed for his qualification for LTx, which was performed without complications.

Physical capacity is an important parameter determining the success of an operation [4]. Unfortunately, there is a lack of data on

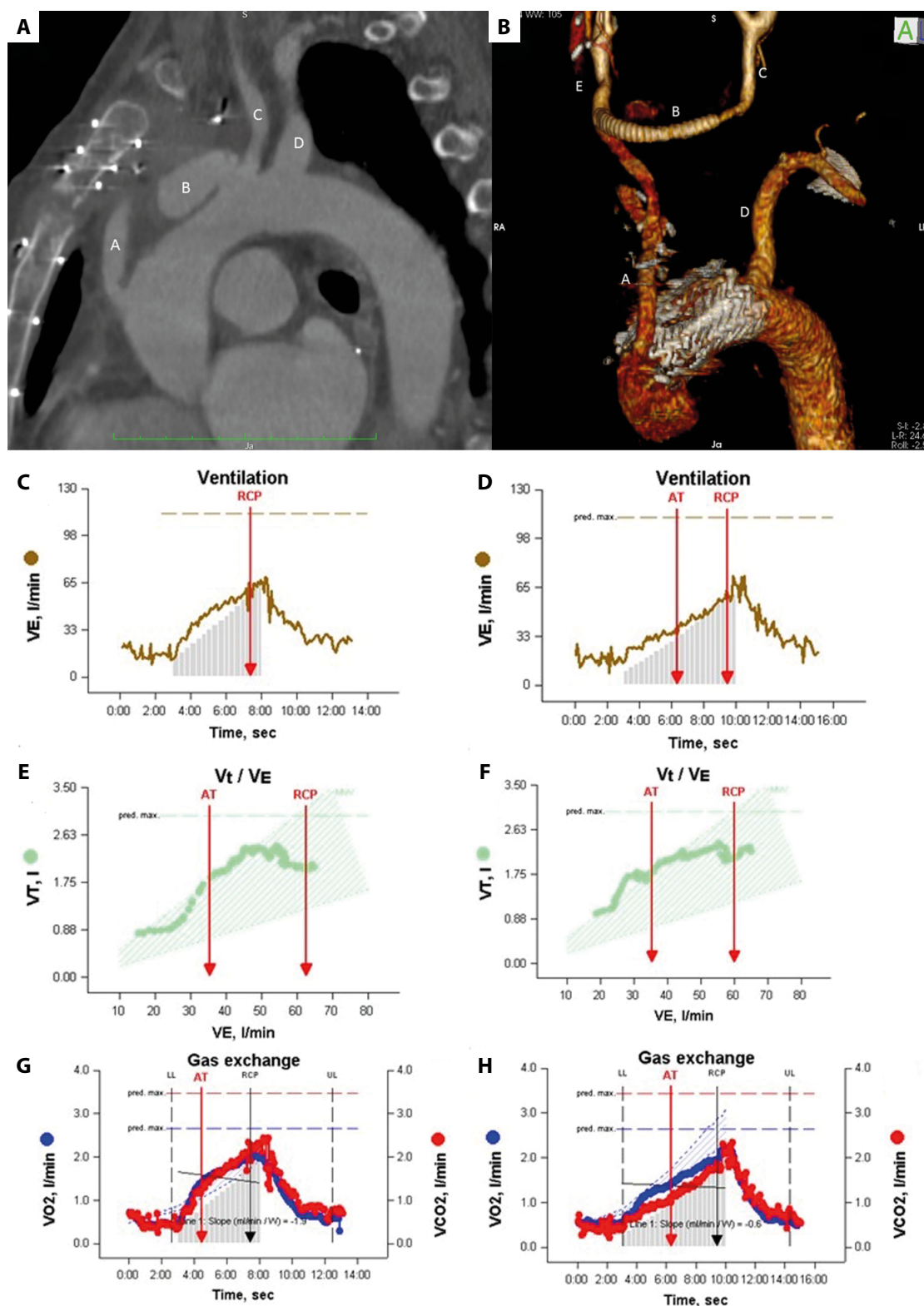


Figure 1. A–B. CT before and after hybrid angiosurgery: **A.** CT scan after cardiac surgery and before hybrid angiosurgery. Pseudoaneurysm of the aortic arch on the level of the origin of the LCCA: A — by-pass from the ascending aorta to the BCA; B — pseudoaneurysm; C — LCCA; D — LSA. **B.** Computed tomography angiography 3D reconstruction after hybrid angiosurgery: A — by-pass from the ascending aorta to the BCA; B — carotid-carotid by-pass; C — LCCA; D — LSA; E — RCCA; **C–H.** Cardiopulmonary Exercise Testing before (left panels — after angiosurgery, right panels — improvement after rehabilitation before liver transplantation): **C, D.** 1st Wasserman's panel: Changes in the profile of ventilation during exercise. **E, F** 7th Wasserman's panel: Changes in relationship between VT and VE during exercise. Left panel presenting a severe pattern of obturation; right panel — improvement). **G, H.** 3rd Wasserman's panel: Profiles of VO_2 and VCO_2 during exercise. Right panel — better cardiopulmonary capacity with higher AT

Abbreviations: AT, anaerobic threshold; BCA, brachiocephalic artery; CT, computed tomography; LCCA, left common carotid artery; LSA, left subclavian artery; RCCA, right common carotid artery; VCO_2 , carbon dioxide production; VE, minute ventilation; VO_2 , oxygen consumption; VT, tidal volume

the beneficial effects of horse riding as rehabilitation in patients suffering from heart and liver diseases. It was analyzed as a therapy for many diseases, but never as a form of rehabilitation after surgery [5]. More research is needed to evaluate the benefits of horse riding on the circulatory system and before LTx.

Article information

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