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Values of gamma-glutamyl transpeptidase are elevated in Fontan patients due to depressed cardiac functions as well as venostasis

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Introduction: Hepatic impairment in Fontan patients is considered to be provoked by liver congestion which is produced under high central-venous pressure. However, hepatic impairment does not exactly occur in Fontan patients with highly elevated pressure of central vein (CVP). In addition, we often find levels of gamma-glutamyl transpeptidase (GGT) highly elevated in Fontan patients whose cardiac functions seem to break down. We predicted hypo-cardiac functions would be major causes about hepatic damages in Fontan patients.

Methods: The medical records of 229 Fontan patients were reviewed aged from 2 tears to 46 years. They underwent cardiac catheterization between 2010 and 2017. We defined GGT 100 UI/L or over was GGT-elevation (n=50). Cardio-pulmonary indexes were determined which were connected with GGT-elevation in Fontan patients. We sought cardiac performances and pulmonary circulation factors related to GGT-elevation.

Results: We obtained following cardio-pulmonary performances related to GGT-elevation in Fontan patients: end-diastole ≥ 142% (p=0.0013); ventricular volumes on end-systole ≥ 72% (p=0.0013); ejection fraction of ventricle ≤ 38% (p=0.00014), cardiac output ≤ 1.7 L/min/m2 (p<0.0001), and moderate regurgitation of atrio-ventricular valve (p=0.011), CVP ≥ 15 mmHg (p=0.035), and pressures of pulmonary capillary wedge ≥ 9 mmHg (p=0.024). After multivariate analysis, GGT-elevation was independently associated with odds ratio of 11.1 for low cardiac output, 5.8 for decreased ventricular ejection fraction, 2.9 for expanded ventricular volume on end-diastol. Fontan patients with GGT-elevation took more amounts of carvedilol and enalapril than those without GGT-elevation. The values of NT-proBNP were higher in GGT-elevation group (962 vs. 216 pg/ml: p=0.00029). The rate of patients were higher in GGT-elevation group who underwent catheterization owing to having some sort of symptoms or abnormal findings (32% vs. 15%: p=0.0054).

Conclusion: Our study showed that GGT-elevation in Fontan patients was not independently associated with CVP elevation but depression of cardio-functions. Cardiac hypo-functions would injure liver by hepatic hypo-perfusion. Absolutely, venostasis, which would diminish the liver, is happening in Fontan patients with CVP elevation. However, CVP elevation would be induced by high afterloads against pulmonary arteries, which was provoked cardiac hypo-function. We should tighten up medical treatment strongly for heart failure to preserve hepatic functions.