Nonlinear MHD simulation of magnetic relaxation during DC helicity injection in spherical torus plasmas TAKASHI KANKI, Japan Coast Guard Academy, MASAYOSHI NAGATA, University of Hyogo, YASUHIRO KAGEI, RIST — Recently, the intermittent plasma flow has been observed to be correlated with the fluctuations of the toroidal current $I_t$ and $n=1$ mode in the HIST spherical torus device. During the partially driven phase mixed with a resistive decay, the toroidal ion flow velocity ($\sim 40$ km/s) in the opposite direction of $I_t$ is driven in the central open flux region, and the oscillations in $n=1$ mode occur there, while during the resistive decay phase, this flow velocity reverses and results in the same as that of $I_t$, and the oscillations in $n=1$ mode disappear there. The purpose of the present study is to investigate the plasma flow reversal process and the relevant MHD relaxation by using the 3-D nonlinear MHD simulations. The numerical results exhibit that during the driven phase, the toroidal flow velocity ($\sim 37$ km/s) is in the opposite direction to $I_t$, but in the same direction as the $E \times B$ rotation induced by an applied voltage. This flow is driven by the magnetic reconnection occurring at the X-point during the repetitive process of the non-axisymmetric magnetized plasmoid ejection from the helicity injector. The oscillations of poloidal flux $\Psi_p$ are out of phase with those of toroidal flux $\Psi_t$ and magnetic energy for the dominant $n=1$ mode, indicating the flux conversion from $\Psi_t$ to $\Psi_p$. The effect of the vacuum toroidal field strength on the plasma dynamics is discussed.