Application of Lanyu pigs as the animal model in osteoporosis study

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Yu-Jing Liao[1], Jenn-Rong Yang[2], Feng-Hsiang Chu[1], Yu-Hsin Chen[1], Lih-Ren Chen[1]
[1]Division of Physiology, Livestock Research Institute, Council of Agriculture, Tainan, Taiwan
[2]Kaohsiung Animal Propagation Station, Livestock Research Institute, Council of Agriculture, Pingtung, Taiwan

Lanyu pigs, the local miniature pig in Taiwan, have been widely used in various biomedical studies. Here we introduced how to generate the Lanyu pig model of osteoporosis and utilize porcine induced pluripotent stem cells (piPSC) to ameliorate their bone loss. The mature female Lanyu pigs were subjected to bone loss inductions for 12 months. Micro-CT images revealed that the combination of ovariectomy + 0.5% calcium diet + 1 mg/kg of prednisolone induced the lowest trabecular bone parameters such as trabecular bone volume, thickness, number, and total porosity, and the lowest proportions of cortical bone in the proximal metaphysis, proximal diaphysis, and distal diaphysis. Next, we designed a protocol to induce piPSC differentiation into osteoblast-like cells, and then they transplanted into the left tibiae of Lanyu pigs for 6 months to implement iPSC-based cell therapy. Results showed that transplantation of piPSC-derived osteoblast-like cells significantly improved trabecular bone structures at transplanted sites and maintained cortical bone structures in the proximal metaphysis. Taken together, these findings reveal the proper combination of ovariectomy, calcium restriction, and prednisolone administration to induce bone loss in Lanyu pigs, and confirm the therapeutic potential of piPSCs to locally recover bone loss in a Lanyu pig model.

Key words: Lanyu pigs, osteoporosis, porcine induced pluripotent stem cells, iPSC-based cell therapy