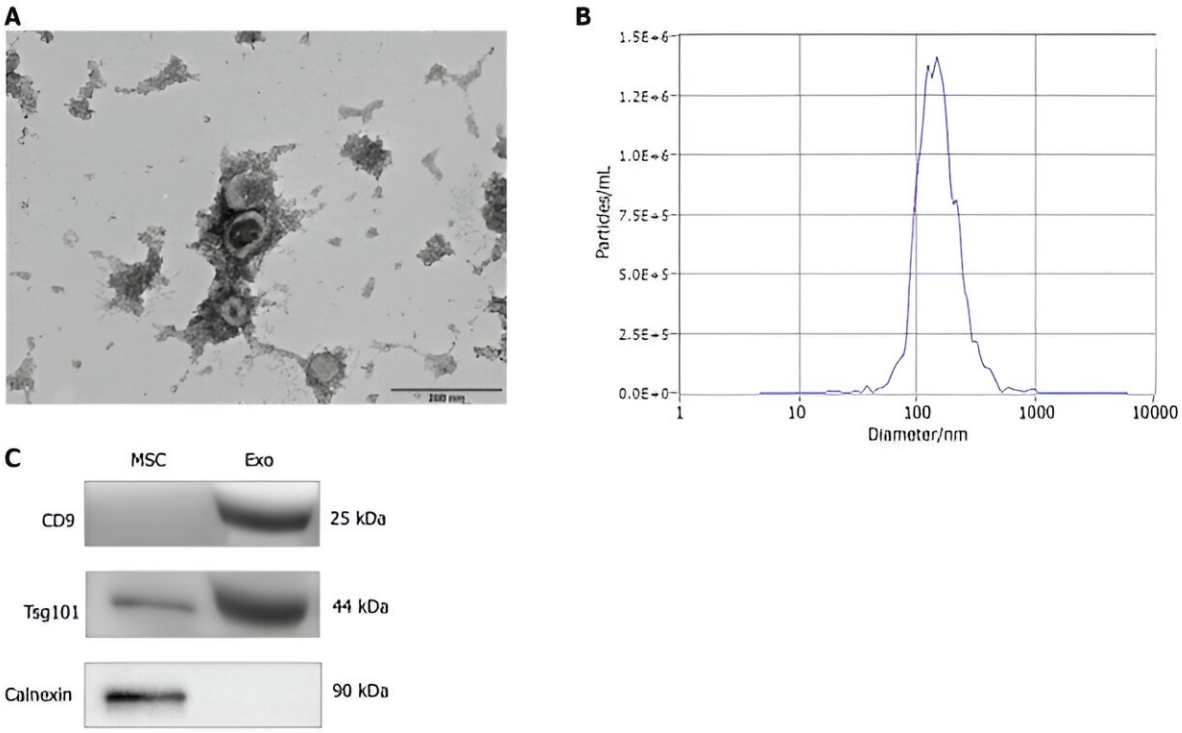
Team reports on enhanced wound healing, hemostasis with exosome-loaded gelatin sponges from umbilical cord stem cells

September 26 2023



Characterization of human umbilical cord mesenchymal stem cell-derived exosomes. A: Morphology of the exosomes assessed by transmission electron microscopy. Scale bar = 200 nm; B: Grain size of the exosomes; C: Surface protein markers of exosomes. MSC: Mesenchymal stem cell; Exo: Exosome. Credit: *World Journal of Stem Cells* (2023). DOI: 10.4252/wjsc.v15.i9.947

Rapid wound healing remains a pressing clinical challenge, necessitating studies to hasten this process. A promising approach involves the utilization of human umbilical cord mesenchymal stem cells (hUC-MSCs) derived exosomes. Recently, a research team sought to investigate the hemostatic and wound healing efficacy of gelatin sponges loaded with hUC-MSCs-derived exosomes.

The team hypothesized that these exosomes, when loaded onto a gelatin sponge, a common hemostatic material, would enhance hemostasis and accelerate wound healing. Their study, titled "Enhanced wound healing and hemostasis with exosome-loaded gelatin sponges from human umbilical cord mesenchymal stem cells," is published in *World Journal of Stem Cells*.

The researchers used ultracentrifugation to extract exosomes from hUC-MSCs. Nanoparticle tracking analysis (NTA), transmission electron microscopy (TEM), and western blot techniques were used to validate the exosomes. In vitro experiments were performed using L929 cells to evaluate the cytotoxicity of the exosomes and their impact on cell growth and survival.

They used New Zealand rabbits for skin irritation experiments, to assess whether they experienced adverse skin reactions. Hemolysis testing was conducted using a 2% rabbit red blood cell suspension to detect possible hemolysis. Moreover, in vivo experiments were carried out by implanting a gelatin sponge loaded with exosomes subcutaneously in Sprague-Dawley (SD) rats to perform biocompatibility tests.

In addition, coagulation index testing was conducted to evaluate the impact on blood coagulation. Meanwhile, an SD rat liver defect hemostasis model and full-thickness skin defect model were used to study whether the gelatin sponge loaded with exosomes effectively stopped bleeding and promoted wound healing.

The NTA, TEM, and western blot experimental results confirmed that exosomes were successfully isolated from hUC-MSCs. The gelatin sponge loaded with exosomes did not lead to significant cell toxicity, skin irritation, or hemolysis, and there was good compatibility in SD rats. Additionally, the effectiveness of the gelatin sponge loaded with exosomes in hemostasis and wound healing was validated.

The results of the coagulation index experiment indicated that the gelatin sponge loaded with exosomes had significantly better coagulation effect compared to the regular gelatin sponge, and showed excellent hemostatic performance in a liver defect hemostasis model. Finally, the full-thickness skin defect healing experiment results showed significant improvement in the healing process of wounds treated with the gelatin sponge loaded with exosomes compared to other groups.

The researchers conclude that collectively, the gelatin sponge loaded with hUC-MSCs-derived exosomes is safe and efficacious for promoting hemostasis and accelerating wound healing, warranting further clinical application.

"In this study, we loaded exosomes derived from human umbilical cord mesenchymal stem cells onto a gelatin sponge, a common hemostatic substance in clinics, to stop bleeding and promote wound healing. The fabricated material appears relatively safe, provides better hemostatic activity than gelatin sponge alone, and promotes good wound healing," they observe.

More information: Xin-Mei Hu et al, Enhanced wound healing and hemostasis with exosome-loaded gelatin sponges from human umbilical cord mesenchymal stem cells, *World Journal of Stem Cells* (2023). DOI: 10.4252/wjsc.v15.i9.947

Provided by World Journal of Stem Cells