Summary

Incisional hernia is the most common postoperative complication which affects up to 20% of patients after abdominal surgery. Insertion of a synthetic surgical mesh has become the standard for care in abdominal wall hernia repair. However, implementation of a mesh does not reduce the risk of recurrence and the onset of hernia recurrence is only delayed by 2-3 years. Nowadays, more than one hundred surgical meshes are available on the market from which the polypropylene is most widely used for abdominal wall hernia repair. Nonetheless, the ideal mesh does not exist yet - it still needs to be developed. The aim of the present study was to develop a functionalized scaffold for abdominal wall hernia regeneration and *in vitro* testing of the new microsphere system with potential use as a drug delivery system in tissue engineering. We prepared novel composite scaffolds based on a polypropylene surgical mesh functionalized with polycaprolactone nanofibers and adhered either platelet as a natural source of growth factors or a synthetic growth factor. In extensive in vitro tests, we have proven the biocompatibility of polycaprolactone nanofibers with adhered platelets on a polypropylene mesh. A histological and biomechanical evaluation from *in vivo* tests revealed better healing capacity of our composite functionalized scaffolds in comparison with either a conventional polypropylene surgical mesh or a simple suture for preventing hernia formation. The microsphere system based on cryogrinded PCL nanofibers has proven its potential to be used as a drug delivery system in biomedical application. The gradual release of growth factors from biocompatible nanofiber-modified scaffolds seems to be a promising approach in tissue engineering and regenerative medicine.