

RESEARCH TOPIC PRIME2

Biomechanical Characterization of Pancreatic Tissue and Development of Adhesives for for Pancreatic Post-Operative Fistola Prevention

Thematic field of the project

Biomedical Science

Research Supervisor

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Main facility

Humanitas University 3D Bioprinting Lab/Pancreatic Surgery Unit

Other facility

- Politecnico di Milano/ DCMC/Nanomedicine Lab
- Politecnico di Milano/ DCMC Artificial Organs @ LaBS

Main field of interest

physical models, medical technologies, devices and systems

Abstract

This project aims to develop a new generation of advanced surgery tools to minimise the occurrence of postoperative pancreatic fistula (POPF) and set up innovative surgeons' training protocols. POPF represents the main cause of mortality and morbidity shortly after pancreatic surgery, and no specific tools have been developed yet to help the surgeons face POPF. This project will be carried out in close synergy between POLIMI and ICH. An artificial replica of the pancreas will be designed, fabricated, and utilised as a realistic phantom, complete with tumour component, for testing different technical solutions to prevent POPF, as well as to develop new training practices for surgeons. Secondly, a sealing device for pancreatic tissue will be developed to reduce the POPF rate. The new patch/glue will be able to seal pancreatic anastomoses and resist the erosive action of pancreatic juices, which is the main reason why glues currently available do not adhere well.

Main technical approaches

The PhD student will develop skills in polymer synthesis, hydrogel preparation, and using analytical tools (NMR, FTIR, SEC) and rheology for material analysis. The student should also be comfortable with data analysis and problem-solving.

Scientific references

- S. M. Strasberg et al., "Proposal for definition and severity grading of pancreatic anastomosis failure and pancreatic occlusion failure," *Surgery*, vol. 141, no. 4, pp. 420–426, 2007. <https://doi.org/10.1016/j.surg.2006.12.001>
- M. Pagnanelli, et al., "A. Analysis of the Mechanical Characteristics of Human Pancreas through Indentation: Preliminary In Vitro Results on Surgical Samples". *Biomedicines* 2024, 12, 91. <https://doi.org/10.3390/biomedicines12010091>
- M. Pagnanelli, et al., "The Choice of the Most Appropriate Suture Threads for Pancreatic Anastomoses on the Basis of Their Mechanical Characteristics." *Biomedicines* 2023, 11, 1055. <https://doi.org/10.3390/biomedicines11041055>
- B. R. M. Perrin et al., "Surgical glues: are they really adhesive?," *Eur. J. Cardio-thoracic Surg.*, vol. 36, no. 6, pp. 967–972, 2009. <https://doi.org/10.1016/j.ejcts.2009.06.026>
- N. S. Berchane et al., "On the mechanical properties of bovine serum albumin (BSA) adhesives," *J. Mater. Sci. Mater. Med.*, vol. 19, no. 4, pp. 1831–1838, 2008 <https://doi.org/10.1007/s10856-007-3360-7>

Type of contract

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