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Innovations in Regenerative Medicine

Monday, October 31st, 13:00 – 14:00

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Cardiovascular Prostheses: Balancing Tissue Regeneration against Clinical Needs

The concept of integrating the patient's own tissue into cardiovascular prostheses evolved when the early euphoria of making cardiovascular spare parts of synthetic materials suffered its first setbacks in the 1960s. As such, it were cardiovascular surgeons who pioneered this quest across all medical fields long before the phrase 'tissue engineering' was forged. Similarly, the desire to avoid complex laboratory-based tissue-generation by making the patient the 'incubator' for the re-growth of his own tissue spear-headed efforts that were later summarized under the term 'regenerative medicine'.

More than half a century later we need to ask ourselves why the ensuing intense and dedicated research has not led to successful broad clinical implementation yet. The answer may lie in poor adaptation to changing clinical needs and a growing detachment of research efforts from their clinical base.

Initiated by cardiac surgeons attempting to create neointimas on total artificial hearts in the 1960s, tissue engineering became fashionable when vascular surgeons pursued the endothelialisation of vascular grafts in the late 1970s. A decade later, it were cardiac surgeons again who strived to improve the longevity of tissue heart valves, and lastly, cardiologists entered the fray pursuing myocardial regeneration. Each of these disciplines and eras started with immense enthusiasm but was only remotely aware of the preceding efforts.

Moreover, the growing complexity of cellular and molecular biology as well as polymer sciences has led to surgeons gradually being replaced by scientists as the champions of tissue regeneration. Together with a widening chasm between clinical purpose, human pathobiology and laboratory-based solutions, clinical implementation increasingly faded away as the singular endpoint of all strategies. Moreover, a loss of insight into the compromised healing mechanism of cardiovascular prostheses in humans resulted in the acceptance of misleading animal models compromising the translation from laboratory to clinical reality. This collective blind-spot had the greatest consequences as uniquely human phenomena such as trans-anastomotic outgrowth stoppage of endothelium and the build-up of internalised but impenetrable surface thombus remained unheeded.

To unleash the full potential of modern tissue regeneration, research foci need to shift from the biologically possible to what is feasible at the intended site and in the intended host environment of patients. Equipped with an impressive toolbox of modern biomaterials and deep insight into cues for facilitated healing, reconnecting to the 'user needs' of patients will eventually make one of the most exciting concepts of cardiovascular medicine a clinical reality.

Chair: Dr. Melanie Generali