WORLD FORUM ON ACADEMIC INNOVATION AND DIGITAL LITERACY

HISTOLOGICAL AND HISTOCHEMICAL EVALUATION OF VASCULARIZATION STAGES IN AUTOLOGOUS AND ALLOGENEIC GRAFTS FOLLOWING MICROSURGICAL TRANSLOCATION

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Abstract : This thesis presents a histological and histochemical evaluation of the vascularization stages in autologous and allogeneic grafts following microsurgical translocation. The study aims to determine the structural patterns of microvascular network formation and the dynamic activity of endothelial markers in graft integration. Using histochemical techniques (such as Factor VIII/vWF and CD31 staining), angiogenesis timeline, endothelial cell proliferation, and extracellular matrix remodeling were systematically analyzed. The findings indicate that autografts demonstrate early neovascularization and minimal inflammatory response, whereas allografts exhibit delayed vascularization accompanied by lymphocytic infiltration. In conclusion, quantitative histochemical criteria serve as reliable diagnostic parameters to predict graft survival and optimize post-operative microsurgical protocols.

Keywords : Microsurgery, autograft, allograft, vascularization, histology, histochemistry, angiogenesis, tissue engineering.

Introduction (Relevance). In modern surgery and tissue engineering, the successful integration of autologous and allogeneic grafts transferred using microvascular anastomoses directly depends on their early vascularization (formation of a functional capillary network). To prevent graft failure, reoperation, or necrosis, evaluating macroscopic blood flow alone is insufficient. Monitoring vessel ingrowth and extracellular matrix remodeling at the cellular and tissue levels remains a highly relevant clinical and scientific challenge. In this context, evaluating the stages of vascularization following re-transplantation through histological and histochemical criteria directly contributes to enhancing surgical outcomes and procedural efficiency.

Research Objective : To analyze the dynamics of angiogenesis and vascularization in autologous and allogeneic grafts translocated via microsurgical techniques using histological and histochemical methods, and to establish comparative evaluation criteria.

Main Part and Methodology. During the study, comprehensive microscopic analyses were conducted on autologous and allogeneic tissue specimens harvested at various post-operative intervals (days 3, 7, 14, and 28) following microsurgical transplantation:

• **Histological Methods :** Samples were stained with Hematoxylin and Eosin (H&E) and van Gieson's stain to evaluate endothelial cell proliferation, capillary density, and the degree of inflammatory cell infiltration.

• **Histochemical and Immunohistochemical Methods:** To identify newly formed blood vessel endothelium and quantitatively assess neovascularization, CD31 and *Ulex Europaeus* Agglutinin-1 (UEA-1) markers were utilized. Additionally, the formation of the basement membrane was analyzed histochemically by measuring Type IV

collagen and glycosaminoglycan expression levels.

Results. Distinct differences in the stages of vascularization were identified between autologous and allogeneic grafts:

• **Autografts:** High expression of the CD31 marker was observed as early as post-operative days 3–4, with active angiogenesis and a well-formed microcapillary network established by day 7. The inflammatory response remained minimal, and complete vessel maturation alongside matrix remodeling was recorded by day 14.

• **Allografts:** Neovascularization proceeded at a slower pace, with the peak of angiogenesis delayed until days 10–14. Synthesis of CD31 and Type IV collagen exhibited a marked delay. Initial stages were dominated by lymphocytic and neutrophilic infiltration, which partially inhibited vessel ingrowth.

• **Histochemical Criteria:** CD31-positive capillary density and basement membrane integrity were confirmed as key objective parameters for predicting graft viability and survival.

Conclusion. The graft integration process following microsurgical translocation strongly relies on specific histological and histochemical indicators of vascularization. While autografts demonstrate rapid and low-reactive angiogenesis, allografts experience delayed vascularization dynamics due to immune responses. Histochemical analysis targeting CD31 and basement membrane markers serves as the most reliable diagnostic framework for evaluating graft status and tailoring targeted pharmacological therapy in microsurgery.

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