TERMINOLOGY AND CONCEPTUAL APPARATUS OF TISSUE DONATION AND TISSUE BANKING: INTERDISCIPLINARY EXPERT CONSENSUS (PART 2)

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The second part of an interdisciplinary expert consensus on tissue banking is presented. An analysis and attempt was made to systematize some of the terms and definitions used by tissue bank specialists in the process of their work and presented in the Federal laws and orders of the Ministry of Health of the Russian Federation regulating medical activities in the field of tissue donation and their clinical use.
Key Words: tissue banking, consensus, terms and definitions.

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The issues of tissue donation are relevant for a long time. The trends of recent decades require the unification of both the technological aspects of transplantation and the assessment of its outcomes, as well as the terminological consensus necessary for the legal regulation of interprofessional collaboration. It is essential to create national associations for tissue procurement, regulation and standardization of all stages of work with donors and donor tissues, and assessment of the quality and safety of tissues, tissue components, and biomedical products based on them [1]. These challenges still remain unresolved that complicates the processes of tissue donation and banking in our country [2–4].

The objective is to update terminology and establish a unified terminology standard in the field of tissue donation and tissue banking.

Methods and Stages

The stages of formulating a unified interrater agreement are described in the first part of the consensus [5]. According to the results of the fourth stage (face-to-face open discussion of the proposed wording of new terminological definitions), the experts have drawn up an adapted list of terms presented below.

Results

The following terms are basic for understanding the approaches to working with tissues and their components.

Autograft, or autotransplant (Greek: autos – own + *transplantatio* – transplantation) or autogeneic transplant is a graft procured by separation from the body (harvesting) and transplanted within the same organism, which is both a donor and a recipient.

Autotransplantation is the transplantation of a part of an organ, tissue, or individual proteins with a change of localization within the same organism [6].

Autologous (Greek: *autos* – self + *logos* – mind, word, thought) is an adjective identifying different objects: cells, tissues, and organs derived from the same organism [7], including those used for appropriate transplantation [8]. A simpler and more understandable definition of the term is "own" [9].

Autoplasty (Greek: *autos* – self + *plastike* – sculpting, plastic) is the restoration or replacement of missing, lost, or injured shape or function of organs or body parts as a result of congenital malformations, disease, injury, or surgery with own tissues, organs, or its fragments [10].

Allograft or allogeneic graft (Greek: *allos* – other + *genos* – genus, origin; analogue before 1971 was "homograft") is a graft obtained from a donor belonging to the same species as a recipient [11].

Allotransplantation (Greek: *allos* – other + *transplantatio* – transplantation; synonym – homotransplantation, from Greek *homos* – identical + *transplantatio* – transplantation) is transplantation of organs and tissues from one person to another person belonging to the same biological species (in clinical medicine – from one person to another) [6].

In the academic literature, isolated use of the word "allogeneic" is used to identify an organ, tissue, donor, or recipient belonging to genetically different organisms of the same species.

Alloplasty (Greek: *allos* – other + *plastike* – sculpting, plasty; alloplastica) is the replacement of defects or correction of deformities with tissues of another person [12].

The term is also used as a replacement for the archaic concept of "homoplasty," implying a technique for surgical replacement of defects, injured tissues, or human organs with parts made of *artificial substance* or tissues and organs of another person [10]. Within this interpretation, "*parts made of artificial substance*" are considered foreign in origin but without species, i.e., they do not belong to biological species. In our opinion, this interpretation is not completely correct and confuses those who are just getting familiar with this field. In 1971, the classification terminology was changed from "homoplasty" to "alloplasty," but the concept's meaning remained the same.

The terms "allovital" and "allostatic graft" are of particular interest [12, 13].

Allovital graft is a graft with preserved viable cells because of which the graft survives (e.g. skin, islet cells of the pancreas, bone marrow).

Allostatic graft is a graft that does not have cellular structures able for maintaining metabolism and proliferation. The term, in fact, is a variant of the ***tissue component*** since cellular structures have been removed from tissues [5]. Example: a lyophilized blood vessel.

Xenogeneic (Greek: *xenos* – foreign + *genesis* – origin; synonym: heterogeneous (from Greek *heteros* – other)): received from a representative of a biological species other than the recipient's one [6].

Xenograft or xenogeneic graft (Greek: *xenos* – foreign + graft; ***heterograft*** in the classification prior 1971) is organs or tissues derived from a donor and intended for transplantation to a recipient belonging to a different biological species (e.g. in human transplantation) [11].

Xenotransplantation (Greek: *xenos* – foreign + *transplantatio* – transplantation; synonyms: heterotransplantation, interspecies transplantation): transplantation of organs, tissues, and/or cells from a donor to a recipient belonging to various orders or classes (in animal transplantation) [6].

Thus, the term "xenogeneic" (Greek *xenos* – foreign + *genesis* – origin; synonym – heterogeneous from Greek *heteros* – other) is used to describe a tissue graft obtained from a representative of a biological species other than the recipient [6].

Xenogeneic tissues derived from animals act as a source of material for mechanical functional tissue components such as tissue components of heart valves, tendons, cartilage, and bones.

NB! If grafts with a large number of cells are used for clinical purposes, with the exception of autografts, it is impossible to completely exclude the risk of complications associated with immunogenicity and incompetibility of allo-/xenografts and/or tissue components. To prevent an immune response of rejection of an allo-/xenogeneic graft and/or a tissue component, antigens must be removed from the tissue. *This section is not an area of interest or competence for both the tissue bank staff and the authors of the article and is subject to a separate review.*

Therefore, the modern interpretation of the issues of transplantation discussed above can be summarized concisely by the following extract: "Biological materials for the restoration of tissue defects are divided by origin into autogeneic (the patients is the donor), allogeneic (the donor is another person), and xenogeneic (the donor is an animal)" [6].

Important terms that influence the understanding of the mechanisms of reparative regeneration when using tissues and/or tissue components are also "inductance," "conductance," and "genicity."

Inductance is the ability of a tissue or tissue component to induce proliferation and differentiation of resident pluripotent mesenchymal stem cells of the surrounding recipient's tissues with the formation of progenitor cells and the development of tissue-specific cells. This property has been detected in growth factors.

Conductance is the ability to form a biological connection between the transplanted material and/or tissue component and the recipient bed through adhesion and stimulation of cell migration, neovasculogenesis, and maintenance of the proliferation process of various types of cells in the surrounding tissues. Many components of the intercellular matrix of graft tissues have conductive features: collagen, vitronectin, laminin, etc.

Genicity is the ability to initiate tissue growth by special viable cells.

The following terms may be mentioned as particular examples:

1) ***osteogenicity*** is the ability to initiate the growth of bone tissue by viable osteogeneic (bone-generating) cells (autobone);

2) ***histogenesis*** (Greek: *ιστός* – tissue and *γένεσις* – formation, development): 1. Tissue development, a set of naturally ongoing processes of the genesis, existence, and restoration of tissues in animal organisms with their specific features in different organs; particular forms of histogenesis are ***osteogenesis*** (formation of bone tissue), ***chondrogenesis*** (formation and development of cartilage), ***fibrogenesis*** (formation and extension of connective tissue – collagen fibers). 2. The set of processes of tissue formation and repair in the course of individual development (ontogenesis).

The general terms illustrate examples of materials for the replacement of bone defects.

Osteoinductive materials are materials containing biologically active substances that induce cells of the recipient's bed (undifferentiated stem cells of mesenchymal origin or progenitor cells of osteoblasts) to differentiate into osteoblasts.

Osteoconductive materials are materials serving as a matrix on which bone is formed in response to the attachment, proliferation, and differentiation of poorly differentiated cells into osteoblasts followed by the appositional formation of bone on their surface.

Osteogenic materials are ones that contain "viable" host cells able to differentiate into osteoblasts and synthesize the basic substance of bone tissue. Osteogenic materials include autobones or tissue components enriched with autogenic bone cells. Meanwhile, the concept of "genic" implies "bone forming" and not "originating" from a bone.

The whole process of handling donated tissues can be divided into three main stages:

1) donation, or the donor stage;

2) tissue storage, processing, and sterilization, or the tissue stage;

3) clinical use, or clinical stage.

Each of these stages is in the area of responsibility of different professional associations and regulations [1, 14].

Stages of tissue handling

The donor stage is a stage aimed at the procurement of donor tissues, including evaluation and examination of the donor and extraction [15].

The evaluation of the donor is part of the donor stage that includes the study of available data (medical background, medical history, diagnosis, cause and time of death, laboratory test findings, etc.) and physical examination to determine indications and contraindications for the possibility of tissue donation.

The donor examination: laboratory tests to detect the presence/absence of such bloodborne pathogens as hepatitis B and C, the human immunodeficiency virus, and syphilis by PCR and ELISA (regulations on the examination of blood donors are used as a basis) [15].

The harvesting of tissues is the process of procuring tissue by separating it from the donor's body without deterioration of characteristics, performed in accordance with national acts regulating the handling of human tissues and relevant ethical standards [16].

The tissue stage is a set of actions including all procedures for handling donor tissues from the moment of transportation, quarantine and modification of the biomaterial, as well as the preservation and sterilization of tissues or tissue components with subsequent storage till their use or disposal [16].

The tissue stage includes performing all steps of the technological process in the laboratory or, if required, with the involvement of third-party organizations for sterilization using radiation or other procedures.

Tissue quarantine is a procedure involving the storage of tissues and/or tissue components with a prohibition on progressing to the next stages of the technological process until negative results of examination for blood-borne infections and bacteriological contamination are obtained, and determining the possibility of further use of tissues for the production of grafts, tissue components, and medical devices.

The quarantine procedure is an effective and reliable way to fight against the transmission of such blood-borne infections as hepatitis B and C, the human immunodeficiency virus, and syphilis through biomaterials, as well as to provide sterility control.

Transportation of donor tissue and/or its components is an activity associated with the delivery of tissue and/or its components from subjects handling donor tissue and/or its components to medical, research, and educational organizations, as well as to organizations that carry out the manufacturing medicines and medical products.

Storage is keeping of biomaterials under certain environmental conditions (pH, ionic composition, viscosity, and other properties of storage solutions or media, as well as at a certain temperature) and for a certain time for further distribution and/or use (permanent, final storage) or during transportation between different organizations involved in procurement, processing, and storage of biomaterials [17]. Tissue banks are professionally engaged in the storage of biomaterials (bone tissue, umbilical cord blood, etc.).

Storage of samples (of tissue) is keeping of tissue samples under certain environmental conditions. Tissue storage can be either short-term (at intermediate stages of handling, starting from the extraction of a sample from a donor) or long-term (before clinical use). Storage techniques are chosen depending on properties (viability, shape preservation, cellular composition, etc.) that are necessary for a specific clinical use. All sequences of tissue storage should be supervised and recorded to ensure that the necessary properties of biomaterials are preserved during storage and to avoid cross-contamination or loss of traceability [17].

The above options can be summarized as follows.

Storage of donor tissue and/or its components is an activity related to providing the integrity of tissue and its components, the availability and protection of donor tissue and/or its components in order to preserve their biological properties.

Modification of a biomaterial is a set of procedures aimed at giving biomaterial samples target characteristics associated with processing and storage [17].

Preservation is the process of using chemicals, changing environmental conditions, or other means during processing to prevent or delay the biological or physical destruction of tissues and/or their components [8]. Preservation is performed by thermal, chemical, radiation, filtration, and other techniques with proven efficiency. Examples of a preservation technique can be cryopreservation, which uses ultra-low temperatures to increase the shelf life of a biomaterial with its pretreatment by adding cryoprotectants [8].

Sterilization is the complete destruction of microorganisms (including bacteria, fungi, viruses, and prions) and their spores on various products, surfaces, and specimens.

The handling of donor tissue and/or its components is an activity for the procurement, storage, transportation, and clinical use of donor tissue and/or its components, as well as for the donation for manufacturing medicines and/or medical products, research activity, and disposal.

Subjects of the handling of donor tissue and/or its components are organizations engaged in the field of the handling of donor tissue and/or its components.

The clinical stage is a set of activities, including all types of medical activities associated with the transplantation of donor tissue and/or its components to a recipient for therapeutic purposes.

The clinical use of donor tissue and/or its components is a medical activity associated with the transplantation of donor tissue and/or its components to a recipient for therapeutic purposes [17].

Conclusion

An interprofesional consensus of experts on the systematization and addition of terms and definitions used in the fields of tissue donation and tissue banking is given. This article compensates for the deficiency and eliminates contradictions regarding the use of tissue grafts and/or tissue components in reconstructive surgery. Unified terminology on the origin, evaluation of properties, the main stages of involvement with donor tissues (1), or the donor stage; storage, quarantine, transportation, modification, preservation, and sterilization of tissues and/or tissue components, or tissue stage (2), as well as the stage of clinical use (3).

With respect to the continuity of information accumulation, we consider this stage of work as intermediate but extremely crucial for the regulation and standardization of all stages of handling donor tissues. In addition, this stage creates a platform for legal support for the procurement and transplantation of biological tissues in general and in reconstructive surgery in particular.

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References

1. **Mironov AS, Borovkova NV, Makarov MS, Ponomarev IN, Andreev YuV.** Tissue banks. World experience. The history of development and current approaches. Transplantologiya. The Russian Journal of Transplantation. 2021;13(1):49–62. DOI: 10.23873/2074-0506-2021-13-1-49-62.
2. **Vorobyov KA, Denisov AV, Golovko KP, Komarov AV, Khominets VV, Kotiv BN.** On the issue of the status of tissue transplants and regulation of tissue donation in the Russian Federation. Russian Journal of Transplantology and Artificial Organs. 2022;24(Suppl):32.
3. **Khominets VV, Vorobev KA, Sokolova MO, Ivanova AK, Komarov AV.** Allogeneic osteoplastic materials for reconstructive surgery of combat injuries. Russian Military Medical Academy Reports. 2022;41(3):309–314. DOI: 10.17816/rmmar109090.
4. **Kirilova IA.** Legal regulation of tissue banking in the Russian Federation. Opinion Leader. 2023;(1(58):76–84.
5. **Kirilova IA, Aleynik DYa, Basankin IV, Bozhkova SA, Borovkova NV, Vorobyov KA, Gilevich IV, Duginova MV, Kozlovskikh OV, Makarov MS, Mushkin AYu, Nikolayev NS, Ovsyankin AV, Ovchinnikov EN, Peleganchuk VA, Ponomarev IN, Ryabykh SO, Smolentsev DV, Shangina OR, Cherdantseva LA, Korytkin AA.** Terminology and conceptual apparatus of tissue donation and tissue banking: interdisciplinary expert consensus (part 1). Russian Journal of Spine Surgery (Khirurgiya Pozvonochnika). 2023;20(4): 92–98. DOI: 10.14531/ss2023.4.92-98.
6. **Kirilova IA, Anastasieva EA, Gubina EV, Cherdantseva LA.** Replacement of Bone Tissue Defects with Allograft in Benign Tumors and Tumor-Like Diseases: A Textbook. Novosibirsk, 2021.
7. **Tarantul VZ.** Explanatory Biotechnological Dictionary: Russian-English. Moscow, 2009.
8. American Association of Tissue Banks. Standards for Tissue Banking, 14th Edition. Revision on January 31, 2020. [Electronic resource]. Available at: https://a498c38321542e3afc7a-6340203f328f3cd60aa87439c450317d.ssl.cf2.rackcdn.com.
9. **Man'ko VM, Devrishov DA.** Veterinary Immunology. Fundamentals: Textbook. Moscow, 2011.
10. Great Medical Encyclopedia, ed. by acad. B.V. Petrovsky. 3rd ed. Moscow, 1975. Vol. 2. P. 12.
11. **Kirilova IA, Fomichev NG.** Issues of reparative regeneration in vertebrology: a historical review of the studies of apprentices of Professor Ya.L. Tsivyan. Russian Journal of Spine Surgery (Khirurgiya Pozvonochnika). 2020;17(4):102–112. DOI: 10.14531/ss2020.4.102-112.
12. Preservation and Transplantation of Tissues and Organs, ed. by prof. G. Krystinov. Sofia, 1975.
13. Alloplant@ Regenerative medicine, ed. by E.R. Muldashev. Ufa, 2014.
14. **Vorobyov KA, Shangina OR, Zagorodniy NV, Smolentsev DV.** Problems of organizing donation, transplantation and tissue banking in the Russian Federation. Russian Journal of Transplantology and Artificial Organs. 2020;22(Suppl):21–22.
15. **Savel'ev VI, Kornilov NV, Kalinin AV.** Actual Problems of Tissue Transplantation. St. Petersburg, 2001.

16. Ensuring the safety and quality control of allogeneic human tissue transplants, compiled by N.V. Borovkova, I.N. Ponomarev, M.S. Makarov, A.S. Mironov. Moscow, 2022.
17. **Akopyan ZhA, Gabbasova LA, Surina ER.** Directory of Iternational Terms Used in Biomedicine. Moscow, 2019.

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