IMMUNODIAGNOSTICS IN POLAND AT THE BEGINNING OF THE 21ST CENTURY

Immunodiagnostyka w Polsce na początku XXI wieku

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ABSTRACT

Immunodiagnostics is the application of immunology to medical practice in the diagnosis of some diseases and monitoring their course. Immunology, the study of immunity, is an interdisciplinary area investigating the pathogenesis of many diseases in almost all medical specialties. It is a relatively new discipline, developed at the turn of the 20th century and originating from microbiology. The rich methodology of immunological laboratory practice turned out to be invaluable when applied to immunodiagnostics. The latter discipline was developed because routine laboratory procedures were unsatisfactory in diagnosing such pathologies as autoimmune diseases, immunodeficiencies or transplant-recipient interactions. Immunodiagnostics soon became independent of general laboratory diagnostics, due to the differences in methodology, special equipment, and relatively high cost of immunoassays.

Keywords: immunodiagnostics, autoimmune diseases, immunodeficiencies, commissioned project, immunodiagnostic procedures, standardization, quality control

Słowa kluczowe: immunodiagnostyka, choroby autoimmunizacyjne, niedobory odporności, projekt zamawiany, procedury immunodiagnostyczne, standaryzacja, kontrola jakości

HISTORICAL BACKGROUND

After World War II, immunodiagnostics evolved in Poland in parallel to other European countries, but due to the differences in technical and financial resources, Poland soon started to lag behind the Western standards. This situation was addressed by the initiative of the Polish Ministry of Science and Information Technology, which in 2005 launched commissioned project no. PBZ-KBN/119/PO5/2005: “Development, improvement, and implementation of complex diagnostic procedures for immunological diseases.” The project was carried out jointly by 32 institutions from different parts of Poland over a period of 3 years. This work resulted in numerous publications, scientific conferences, as well as procedures developed for particular immunological diseases. The standardization and quality control of immunoassays improved. The project also set up a web site.1 Thanks to the fact of dissemination of clinical immunological knowledge, the number of immunodiagnostic laboratories in Poland increased during the term of the project. Some of those laboratories are equipped with state-of-the-art apparatus and often located outside health care facilities.

In summary, it seems that immunodiagnostics has become an integral part of Polish clinical medicine.

THE PLACE OF IMMUNODIAGNOSTICS IN LABORATORY DIAGNOSTICS

Immunodiagnostics is the practical application of immunology. Immunology, the study of immunity, deals with investigating the pathogenesis of a great number of diseases and mechanisms in almost every medical field. It can be traced back to microbiology, as almost all of the pioneering immunologists, such as Pasteur, Koch, and Metchnikoff, were microbiologists. Methodology has always been a strong point of immunology, and the Journal of Immunological Methods enjoyed and continues to enjoy great popularity on the Internet.

1 www.diagnostyka.immuno.net.pl.
At a certain point in its development, routine laboratory diagnostics accepted immunodiagnostics as a new approach to the investigation of pathological issues whose mechanisms were not previously clear, such as autoimmune diseases, immunodeficiencies, and transplant-recipient interactions. Following World War II, the first immunodiagnostics laboratories in Poland were usually established on the basis of microbiology and anatomic pathology units at medical academies. Examples from the 1960s include the Immunopathological Laboratory at the Anatomic Pathology Unit, Medical Academy of Warsaw (Dr. A. Nowosławski and Dr. W. Brzosko) and the Immunohistochemistry Laboratory in Poznań (also at the Anatomic Pathology Unit).

**Current situation**

Since its beginnings, immunodiagnostics has been a separate and independent laboratory discipline due to its distinct laboratory equipment and methods, as well as different pathogenesis of diseases. It has been only gradually incorporated into day-to-day practice of disease diagnostics, due to the low awareness of the medical community and the high costs of assays linked to the use of special apparatus and expensive reagents. Classical laboratory diagnostics started to increasingly implement immunological methods and techniques for its own needs, thus improving the quality and turnaround time of many tests. Modern automated laboratory analyzers quantitatively determine many proteins in body fluids, mostly using antigen-antibody interactions, in dozens or hundreds of specimens at the same time.

Furthermore, simpler immunological tests, especially in the field of immunochemistry (e.g., quantitative assessment of immunoglobulins, tumor markers, complement components) have been incorporated into general diagnostic laboratories. Strictly immunological laboratories tend to focus on more complicated measurements, such as functional cell assays, immunophenotypic analysis, etc.

The increasing awareness of the medical community and the introduction of immunology to university medical courses led to greater pressure exerted by clinicians on diagnostic laboratories to offer more complex immunoassays. Moreover, doctors increasingly often use various immunological parameters to monitor diseases and treatment effects. For instance, determination of T CD4+ lymphocyte subpopulations has become one of the major factors in evaluating HIV-AIDS severity.

This approach is also used in evaluating the response of hematopoietic diseases, such as leukemias and lymphomas, to treatment. This poses new challenges to immunological laboratories, in terms of apparatus, standardization, and quality control.

**Data from the commissioned research project PBZ-KBN/119/P05/2005**

The aforementioned needs were acknowledged by the Ministry of Science and Information Technology, which, at the beginning of 2005, ran a notification on launching commissioned project no. PBZ-KBN/119/P05/2005 “Development, improvement, and implementation of complex diagnostic procedures for immunological diseases” in the Rzeczpospolita daily. Unfortunately, a relatively small number of institutions responded to the project notification, and eventually only 32 institutions participated; they were grouped into four consortia:

- the Secondary Immunodeficiencies Consortium,
- the Hematopoietic System Neoplasms Consortium,
- the Primary Immunodeficiencies Consortium
- the Autoimmune Connective Tissue Diseases Consortium.

However, three of the participating institutions worked as independent units; they dealt with:

- myeloid leukemias and lymphoproliferative neoplasms,
- autoimmune diseases of the hematopoietic system,
- diagnostics of immunity-related causes of infertility.

The Project Program Board was appointed from among directors of the institutions and a web site (www.diagnostyka.immuno.net.pl) was created as a platform for collecting the data obtained during the project and as a forum for discussion. The web site has been recently modified and updated, to make it more helpful to physicians and immunodiagnostics.
Due to the fact that the project lasted for less than three years and could not be extended, it was impossible to fully implement and disseminate the developed research patterns. The project gave rise to rich material with theoretical, practical, and organizational implications.

All the consortia developed a number of detailed procedures for particular diseases, most of which were published in Polish scientific journals. The procedures concerned not only the tests themselves, but also specimen collection and transport, and safe handling of potentially infectious material.

The project participants published some monographs concerning selected areas of immunodiagnostics, such as *Cytometric Methods.*

Some consortia conducted blind studies on the quality of diagnostic tests, delivering coded samples of biological material and reagents to different laboratories. The studies revealed considerable discrepancies between the results reported by the laboratories, which was probably due to differences in apparatus and research habits.

An important role in disseminating knowledge of clinical immunology, and especially of highly specialist diagnostics, in medical practice, has been played by many conferences organized in Poland by the project participants, as well as by presentations delivered by them at numerous scientific congresses. According to the final report of the project, a total of 98 events took place. Two conferences entitled *Standardization in Immunology* were held in Poznań (in 2007 and 2008). Along with the project participants, attendees included many clinicians and laboratory diagnosticians not involved in the project, as well as some international guests. Furthermore, some more narrowly specialized conferences were held by particular consortia. The Primary Immunodeficiencies Consortium was particularly active, as it held 8 conferences, while the Hematopoietic System Neoplasms Consortium held some cytometric conferences and workshops presenting the principles of leukemia and lymphoma immunophenotyping. The Secondary Immunodeficiencies Consortium organized 2 conferences, mainly devoted to state-of-the-art diagnostics of viral hepatitis, as well as a meeting entitled *New Infectious Diseases – The Role of Hygiene.*

Much attention was given to indications for antibody determination and standardization. These issues were presented and discussed at the 6th *Immunopathology in Clinical Diagnostics Conference,* which was held alongside the 2nd *Standardization in Immunology Conference* (Poznań 2008), as well as at local conferences, such as *ABC of Immunology.* An important effect of the work of the institutions collaborating on the project was the implementation of some immunodiagnostic procedures. It seems worth mentioning here diagnostic standards for immunological anemias, modern methods of detecting male infertility, detailed diagnostic procedures for some immunodeficiencies, etc.

The demand for highly specialized immunoassays has markedly increased not only in university hospitals, but also in municipal and county hospitals. The medical community is now better educated in terms of immunology. The clinicians are aware, that immunodiagnostic tests make it possible not only to obtain a more accurate diagnosis, but also monitor the course of a disease.

Some new classifications of diseases have been introduced and also some specializations have been modified in this respect – for instance in hematology immunoassays, especially those using flow cytometry, have become commonplace in day-to-day clinical work. The best examples are tumors of the hematopoietic system – many physicians would now be unable to diagnose them without the help of immunodiagnostics. This is also true of congenital and acquired immunodeficiencies.

This situation leads to certain logistical consequences. The number of laboratories offering immunoassays is on the rise. There is mounting pressure on quality improvement and standardization, while some companies are trying to capture the market of diagnostic tests. However, it is more difficult to capture the market of immunoassays, due to the greater complexity of the tests, expensive apparatus, and the fact that laboratory personnel must have substantial immunological knowledge. Two fields of specialization have developed – clinical immunology for physicians and medical laboratory immunology for laboratory personnel. These two should produce highly qualified personnel to conduct and assess such tests.

Due to the high costs of modern apparatus and reagents as well as the requirements of quality control, some hospital laboratories are not able to conduct highly specialized immunodiagnostic tests. This function is taken over by commercial companies, often linked to large Western corporations, which offer such tests on an outsourcing basis (outside the ordering physician’s facility).

Such a solution has both advantages and disadvantages, with the greatest drawback in most cases being a much longer turnaround time.

PROSPECTS FOR THE FUTURE

The new challenges and prospects for Polish immunodiagnostics, some of which are already being implemented, include: immunological monitoring of organ transplants (e.g., kidney, liver, heart, and especially bone marrow transplants). Bone marrow transplants in leukemias, lymphomas, and primary immunodeficiencies should be routinely monitored using multicolor flow cytometry.

In summary, it seems that modern immunodiagnostics has become an indispensible element of Polish clinical medicine.

REFERENCES


