Infectious Screening of Blood Components: Is There Still a Need for Further Inventions?

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The current issue of *Transfusion Medicine and Hemotherapy* is dedicated to novel aspects of infectious screening of blood products. In times of continuous technological evolution and ongoing progression in the development of pathogen reduction technologies, we need to question whether infectious screening of blood products is still necessary and what the future will look like. The articles in this issue focus on viral [1–3] and bacterial screening assays [4, 5], reflecting current national test strategies and requirements. In the historical review of the introduction of nucleic acid amplification techniques (NAT) in transfusion medicine, it became obvious that new developments are required to counteract the biological diversity and adaptability of blood-borne pathogens and the need for constant attention and mindfulness in surveillance systems.

Although the worldwide screening of donated blood for transfusion-transmissible infections has been established for decades, constant adaption and improvement in line with changing situations are required. Last but not least, the appearance of new emerging pathogens in the last decades (arboviruses), the rediscovery of well-known but sometimes undervalued pathogens such as hepatitis E virus, or the modification of test strategies due to new challenges, such as the genetic variability of pathogens, are still existing challenges for transfusion medicine. The introduction of pathogen reduction technologies is becoming more and more concrete, although a complete launch of pathogen reduction technologies for all blood products, in particular for RBC, is still not foreseeable. Promising developments have been made in recent years, however, especially for RBC [6] or whole blood [7].

In addition to the quality of screening assays, the technical implementation, taking into account the respective national legal requirements and a cost-benefit analysis, is also of primary interest. A look back at the first steps in the introduction of NAT in transfusion medicine not only highlights the historical problems and resistance to transposition to routine testing of blood products, but also allows us to derive the appropriate conclusions for future challenges.

In this context, Roth reviews the history and future of NAT blood donor testing [1], triggered in the mid-to-late 1990s by worldwide identification in post-transfusion non-A-non-B hepatitis patients, later identified as HCV, and the discovery of AIDS and its causative agent HIV. These emerging pathogens required rethinking of established test strategies and opening for new methods, such as NAT. In Germany, the omission of early introduction of NAT delayed the improvement of blood safety. In the 1990s, the HIV scandal led to a sustained public awareness and upheavals, with changes to German medicines law and the creation of a new authority, the Paul Ehrlich Institute. In future, this historical error of late assay introduction should admonish us to take emerging pathogens seriously. The ongoing question is: how to make blood products completely free from pathogens and thus as safe as possible? Two good and current examples of improved attention and surveillance in transfusion medicine are the particular bacterial safety of platelet concentrates, and the recent introduction of new tests for the pathogen hepatitis E virus.

New pathogens are constantly emerging, demanding new inventions for infectious screening. However, patho-

gens undervalued or overlooked in the past can suddenly warrant increased attention. In this context, a most recent prominent example is Europe's new problem with hepatitis E [8]. The various countries have dealt with this new pathogen in very different ways, and Boland and coworkers [3] present an up-to-date overview of the current situation in various European countries, supplemented with new experiences from Ireland. Nevertheless, beneath the development of new strategies to defend infectious risk in transfusion medicine, a constant surveillance of implemented screening algorithms is also necessary to check whether they are still state-of-the-art or might overlook hitherto unknown risks. A still unknown quantity is the remaining risk of non-confirmed initial reactive samples. In that sense, Stolz and coworkers [2] present a follow-up data analysis of non-confirmed initial reactive samples tested with an ID viral screening approach.

However, risks do not only exist with regard to viral infection since bacterial contamination of platelet concentrates still remains a persistent problem in transfusion medicine. One major issue is implementation of the optimal screening strategy, which is more difficult to determine due to an initially very low contamination alongside the capability of bacteria to proliferate. Again, different countries have dealt with this issue in very different ways,

and Prax et al. [4] give a comprehensive overview of currently available test strategies in different parts of Europe. Aspects like shelf life of platelets, time of sampling, and the applied control measures are compared between the different countries. Vollmer et al. [5] contribute with 7 years of experience with bacterial screening, combined with late sampling using the Bactiflow methods, demonstrating that bacterial screening is worth the effort.

Nonetheless, the implemented safety measures are only valuable for a limited number of selected viruses, mainly due to the limited available technical and methodological spectrum. A promising technology to further increase blood safety could be next-generation sequencing. Waldvogel-Abramowski and coworkers [9] present a promising state-of-the-art review. Viral metagenomics of blood donors and blood-derived products has the potential to explore the whole virus landscape in blood donors, to investigate a severe transfusion reaction of unknown etiology, or, in the somewhat distant future, to introduce new routine testing platforms to screen donations.

Overall, this issue of *Transfusion Medicine and Hemotherapy* provides an insight into the history and new developments of infectious screening, as well as the challenges and difficulties concerning improvement of blood safety.

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