

ERYTHROCYTE AGGREGATION : SUMMARY, CONCLUSIONS AND PROSPECTS

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The First international symposium on "Hemorheology and Erythrocyte Aggregation" held in Geneva, stressed the importance of this microrheological parameter in Hemorheology and the various theoretical approaches. This symposium essentially tried to define the theoretical, biochemical and structural aspects of erythrocyte aggregation with reference also to its physiological implications ; the clinical applications were of secondary importance.

Two years later, the second international symposium held in Paris, was a logical continuation of the first symposium and followed the international congress of Biorheology held in Vancouver in July 1986 and the 5th Congress of Clinical Hemorheology held in Bordeaux in June 1987. Despite the brief interval between these two congresses, an important part of the scientific programme was devoted to clinical applications. The advances of the second international symposium can be schematically divided into three parts :

- Review of theoretical data
- Development of methodologies
- Clinical applications

1) Development of theoretical data concerning erythrocyte aggregation was the subject of 9 papers. BROOKS discussed the impact of fibrinogen on erythrocyte aggregation. Two mechanisms were discussed : intercellular bridging requiring macromolecular absorption on the surface of the erythrocyte and a mechanism caused by macromolecular depletion on the cell surface. More generally, the influence of the principal plasma proteins (fibrinogen, immunoglobulins and albumin) was discussed by DONNER et al. In particular, the competitive role of albumin during aggregation by immunoglobulins should be stressed. The importance of cellular properties (age of erythrocytes, cell load, deformability, volume...) was studied by MEISELMAN et al. According to these authors, these parameters must be taken into consideration in the same way as plasma factors in the evaluation of clinical situations.

2) Methodological progresses : The necessity for strict experimental conditions and the definition of the parameters necessary for the rheological approach to erythrocyte aggregation have led to the design of new equipment such as the erythroaggregameter (SEFAM). This new computerised system is based on the analysis of light by a blood suspension subjected to variable shear stresses. Data processing allows an approach to all of the parameters of aggregation (kinetic, rheological...). This method and the various parameters likely to influence the results were analysed by PIGNON et al. Another approach involves simulation of the behaviour of blood in the microcirculation by a flow technique through a filter (TEITEL). Lastly, ultrasonography may prove to be a promising technique for the future inasmuch as it may allow a reliable measure-

ment of the size of aggregates according to the shearing forces. In the more theoretical field of viscosimetry, QUEMADA analysed the parameter "aggregation", by establishing the conditions for modelisation of rheograms. Lastly, DUFAUX et al. demonstrated the essential role of erythrocyte aggregation in microcirculatory flow, both in vitro and in vivo.

3) Clinical applications : This session consisting of 13 papers was opened by a general conference on inflammation by A.L. COPLEY. He stressed that over the last few decades, hemorheological studies devoted to this subject have only exceptionally dealt with cellular rheological behaviour and erythrocyte aggregation, despite the important role of these phenomena. In the context of clinical studies, we should stress the studies on erythrocyte aggregation in neonates presented by CLIVATTI et al., the repercussions of local and general anaesthesia on this parameter (ADJIZIAN et al.) and the studies by SCHOONEMAN et al. on monoclonal dysglobulinaemias in which erythrocyte aggregation appears to be an important parameter for the laboratory monitoring of this disease. We should also mention the contribution by WITTE et al. on the parameters of viscoelasticity of blood related to atheromatous risks in patients with cardiovascular diseases.

The hemorheological disorders observed in hypertension were discussed by ZANNAD et al. in their paper on the correlation between rheological parameters and measurement of blood pressure and the echocardiographic index related to left ventricular hypertrophy. The results confirm the existence of important hyperviscosity syndromes in HT with increased erythrocyte aggregation. Recent studies have also confirmed the presence of anomalies of erythrocyte aggregation in diabetes, emphasizing its potential role in the development of microangiopathy. The same applies to erythrocyte aggregation in venous pathology, where an excess of aggregates and/or a raised threshold of dissociation leads to the appearance of pathological aggregates. It is possible, in this case, to speak of "venous rheopathy", which would actually be the end result of a cascade of events : slowing of blood flow, reduced local shear stress, increased erythrocyte aggregation and fibrinogen leading to a reduction in erythrocyte deformability. This corresponds to the double vicious cycle concept already proposed during the first symposium.

In conclusion, this 2nd symposium reviewed the progress in the clinical studies of erythrocyte aggregation. It is important for these studies to confirm the role of hemorheology in clinical practice, especially in the cardiovascular field. The methodological and theoretical presentations showed that reliable and reproducible techniques are now available which can be used in controlled clinical studies.

On the basis of this progress, it is reasonable to expect that a 3rd symposium would allow a very precise definition of the role of erythrocyte aggregation in clinical practice.