DISSEMINATED INTRAVASCULAR COAGULATION IN NEONATES

ESSAY

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BY

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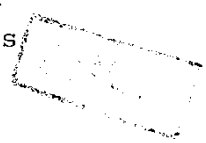

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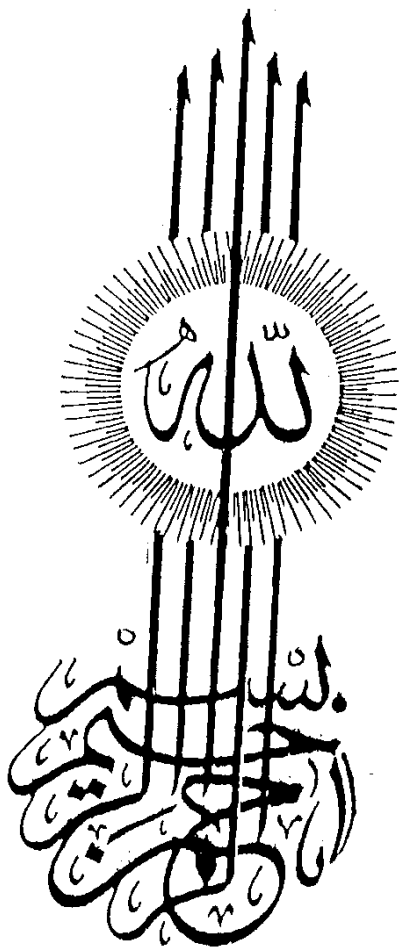

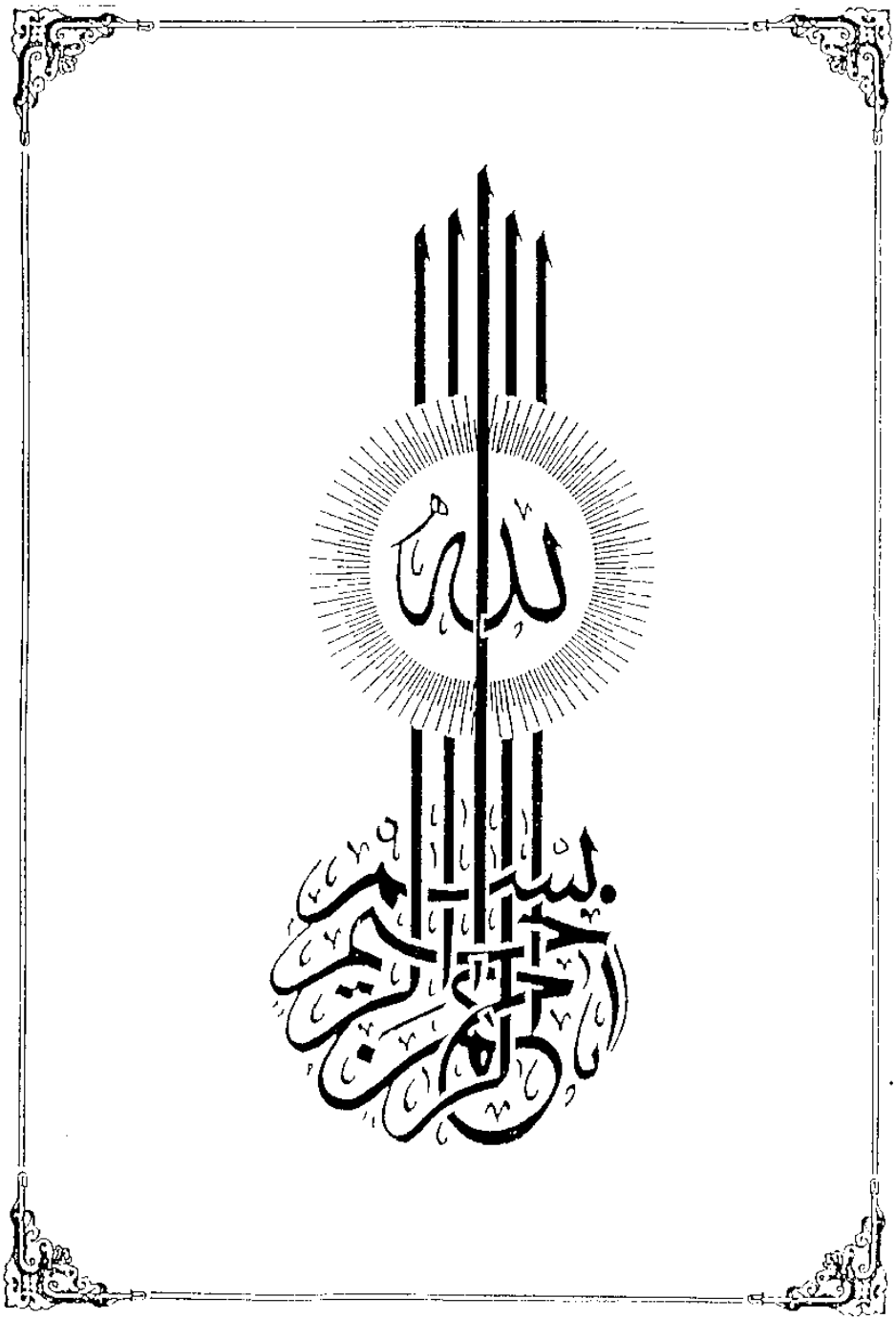

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INTRODUCTION AND AIM OF THE WORK

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Disseminated intravascular coagulation (DIC) is defined as a syndrome resulting from activation of the coagulation process in vivo.

DIC is a serious complication of various pathological conditions. It usually occurs in sick infants born after complicated pregnancy or delivery who develop symptoms within the first 24 hours of life. If bleeding occurs later, it is often associated with infection.

In this essay, a review for the most important clinical circumstances which predispose to evolution of this syndrome in neonates together with the clinical manifestations, pathology, methods of diagnosis, complications and treatment is presented.

In order to understand the mechanism by which DIC is produced, this necessitates understanding of the physiology of blood coagulation and fibrinolysis.

The aim of this work is to through the light on the most important predisposing factors for this condition, methods of diagnosis, prevention and treatment in newborn infants.

HISTORY AND DEFINITION

History and Definition of DIC

Manasse (1892) observed hyaline material and thrombi appearing in various organ systems when two injections of heat killed typhoid bacilli were injected at 24 hour intervals. A similar observation was made by Kusama (1913) who found "fibrin knots" after a spaced injection of heat destroyed bacilli. In these experiments the kidneys were not examined.

Sanarelli, in 1894, observed that after two injections of typhoid toxin 24 hours apart, a generalized purpura preceeded death of monkeys. This author presented the first exact pathological description and indicated that a variety of endotoxins could produce the same results. The discovery of this phenomenon was attributed to Sanarelli (Sanarelli phenomenon).

Shwartzman (1927) was the first to attempt to define what he termed the generalized Shwartzman reaction. The criteria he employed were haemorrhagic diathesis with renal cortical necrosis after two injections of endotoxin within 24 hours. They resulted in shock and death within 48 hours after the second injection. Lindberg and Riggins (1963) found that in nephrectomized animals, fibrin depositions developed in other organs such as the spleen and the lungs.

Now, the term "Disseminated intravascular coagulation" is used for this phenomenon and the other names are reserved for experimental models (Nils et al, 1971).

Definition of DIC:

Disseminated intravascular coagulation (DIC) may be defined as a process characterized by activation of the coagulation system in vivo with the formation of either soluble or insoluble fibrin.

Clotting factors are consumed and there is secondary activation of fibrinolysis. Many terms are used to describe this process including: consumption coagulopathy, Intravascular coagulation-fibrinolysis syndrome (ICF syndrone), defibrination syndrome and acquired hypofibrinogenaemia, Sanarelli Shwartzman phenomenon (SSP),generalized Swhartzman reaction (GSR), Swhartzman equivalents and thrombo-haemorrhagic phenomena (Jean, 1980).

DIC should not be considered as a disorder in itself but as a process that is caused by a great variety of underlying diseases. Therefore, the clinical and laboratory manifestations are extremely variable and not only depend on features due to DIC but also on the underlying disease (Donald, 1982).

As the name implies, disseminated intravascular coagulopathy is characterized by wide spread thrombosis resulting in tissue ischaemia with abnormalities of function in one or more organs. It is suggested that throughout life there is continual deposition of fibrin on endothelial cells which have been damaged by the stresses of the circulation, (G.A.B. et al, 1980). The fibrin is then removed by the action of the fibrinolytic enzyme system which serves to maintain the patency of the vascular tree. Therefore, there is a finely balanced equilibrium between the coagulation and fibrinolytic enzyme systems. Increased deposition of fibrin may be a consequence of impaired fibrinolysis or as a result of excessive concentration of procoagulant material within the circulation, (A.V. Hoffbrand & Lewis, 1981).

Importance of DIC in neonates:

Intravascular coagulation in the newborn is often more difficult to identify than that in an older child. As in the older child, it is often associated with another illness commonly sepsis or shock, but it must be remembered that the normal values observed in neonates differ from those obtained in older infants, children or adults. Normally, there is low concentration of vitamin K-dependant clotting factors in plasma of the newborn, so the laboratory confirmation of suspected DIC is not clear (David & Frank, 1981).

Disseminated intravascular coagulation occurs in up to 10 per cent of sick infants admitted to neonatal intensive care unit (Mehta, et al, 1980).

The mortality rate reported in series of patients with DIC due to various etiologies is 50 - 85 % (Mant & King, 1979) and this variation probably reflects the mortality from DIC per se. This hypothesis is supported by the fact that the mortality of DIC associated with placental abruption is < 1 % (Pritchard & Brekken, 1967), whereas that associated with infection and shock is 50 % - 80 % (Mant & King, 1979). Therefore, there is no doubt that the major determinant of survival is the underlying disease and that DIC per se probably contributes little to overall mortality.

For this reason, in addition to the tremendous variations that this complication causes in individual patients, it is extremely difficult to evaluate the effects of therapy (Mehta et al., 1980).

Doyd found evidence of DIC in 3.5 per cent of neonates who had died within 48 hours of birth and in 16 per cent of those dying after 48 hours (Thompson, 1977).

The British births survey of 1970 lists haemorrhage as the primary cause of death in 5 per cent and as the

secondary cause in 4 % of infants dying in the first week of life (Jean, 1980). The newborn infant is particularly vulnerable to many stimuli that promote pathological activation of coagulation such as sepsis and hypothermia. The defensive mechanisms which are the reticuloendothelial system and the fibrinolytic system are less functionally efficient in the newborn. The role of the reticuloendothelial system in clearing intermediate products of coagulation is well established. The spleen is less effective as a reticuloendothelial organ in the newborn than in adult. So, the newborn is not only more exposed to the risk of DIC but also less able to cope with it than older children and adults (Theodore, 1974).

PHYSIOLOGY OF BLOOD COAGULATION AND FIBRINOLYSIS

Physiology of blood coagulation and haemostasis:

Coagulation is the process of formation of coagulum by solidifaction of fibrinogen. This alteration in fibrinogen is the only observable change that occurs in the blood, but it is certainly preceded by a long chain of preliminary reactions.

Haemostasis is the process by which spontaneous or induced bleeding is stopped. It starts by a phase of vascular contraction, during which the blood normally clots below the surface of contracted vessels, and when the vessel relaxes, the proximal lumen is locked by the clot (Biggs, 1962).

Constriction following injury appears to be an intrinsic property of small blood vessels, particularly the small arterioles and precapillary sphincters. There is little evidence that reflex vasoconstriction is important in haemostasis. In man, there is no evidence that either sympathectomy or pharmacologic blockade of the adrenergic nervous system significantly impairs haemostasis (Henry & Steiman, 1968).

The platelet phase of haemostasis:

The major function of platelets is hemostasis, platelets play both a mechanical and a biochemical role.