INTERVENTIONAL CARDIAC CATHETERIZATION IN CONGENITAL HEART DISEASES

ESSAY

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By

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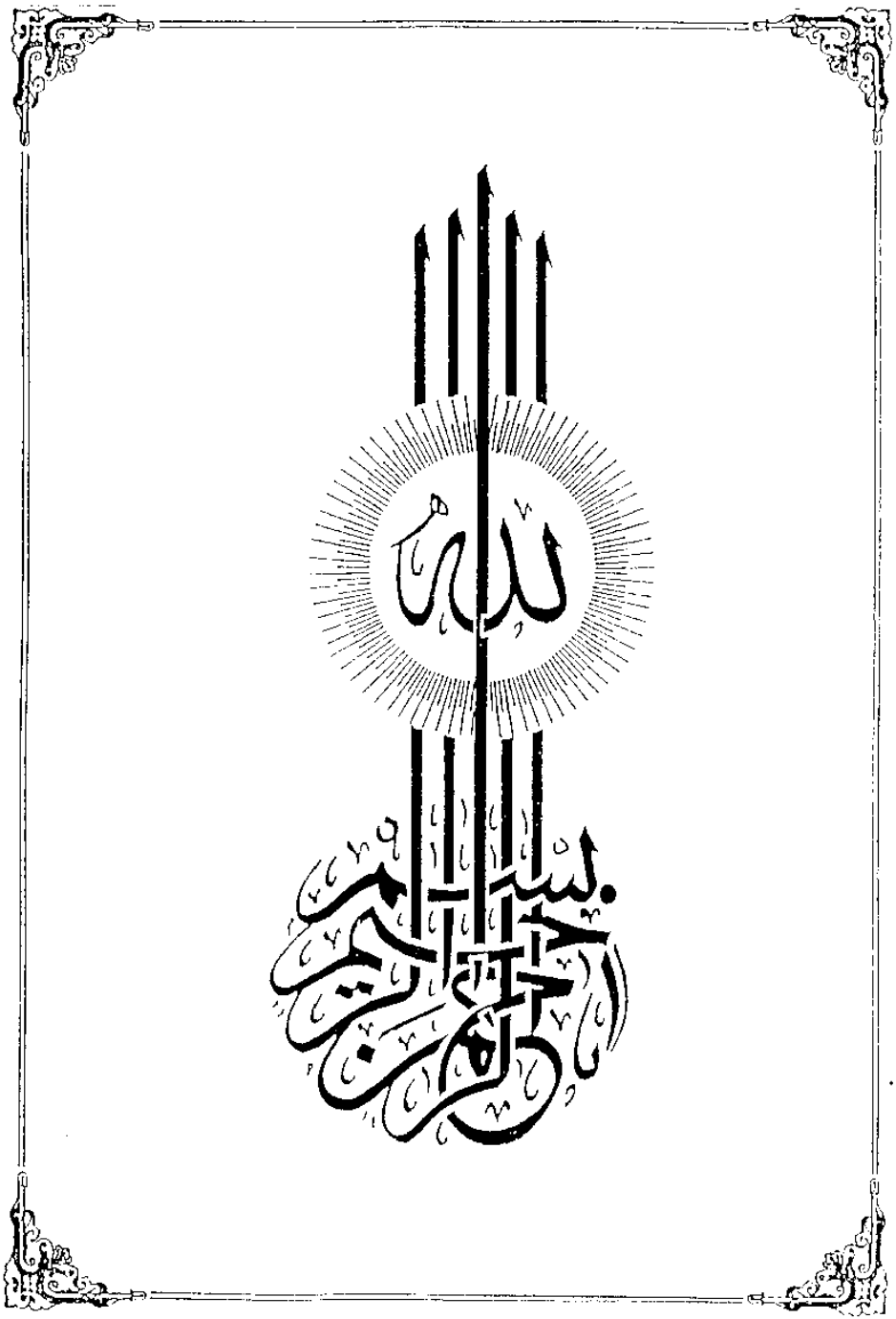
To the Memory
of My Father



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Ibrahim El Mallah

"For mere living is not a good, but living well.

Accordingly, the wise man will live as long

as he ought, not as long as he can ....

It is not a question of dying earlier or later,

but of dying well or ill.

And dying well means escape from the danger of living ill."

Seneca, 1976

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INTRODUCTION

INTERVENTIONAL CARDIAC CATHETERIZATION IN CONGENITAL HEART DISEASES

Introduction:

Man's awareness of illness of the heart dates back to at least the twenty-sixth century B.C. In the yellow Emperor's Book of Medicine, the following is found:

> "Long slow pulse beats make its good regulation, short empty beats prove its disorderly condition, quick pulse with more than 6 heart beats per one respiratory cycle proves a sickness of the heart, beats per one respiratory cycle proves a sickness of the heart, a broadly slow pulse signifies a deterioration of the disease."

The Ebers Papyrus (sixteenth century B.C.) contains the statement:

> "On whatever part of the body a physician puts his fingers - on the neck, on the hands, on the region of the heart, on both arms, on the feet - he encounters the heart everywhere, because its vessels are for all the limbs; this means that it (the heart) speaks through the vessels of all the limbs.

It is difficult to date man's knowledge of congenital heart disease. Autopsy analysis of congenital heart disease is very new, but one type of congenital cardiac malformation must have been observed by the ancients.

A Babylonian tablet, one of hundreds in the British Museum and one of thousands known to exist, contains the lines:

"When a woman gives birth to an infant that has the heart uncovered and that has no skin, the country will suffer from calamities."

Thus, the ancient Babylonians, who used abnormal animal and human births for divination, saw and described ectopia cardis. How old is the document? According to Ballantyne writing about this tablet in 1894 *(Rashkind, 1983)*.

Cyonosis has long been recognized. Many illustrations of blue skinned Egyptians may be seen in their necropolis frescoes, and they described cyanosis in the Smith Papyrus.

Of course, the Egyptians did not diagnose cyanotic congenital heart disease, but the fate of such a patient was no different from what it would be for the next 4500 years.

Only in the last half of the twentieth century has the lot of such a patient improved. For it was then that Drs. Helen Taussing and Alfred Blalock devised the first effective treatment for patients with cyanotic heart disease. Dr. Taussing followed her pioneering work on the understanding and treatment of congenital malformations of the heart with the Publication in 1947 of her classic book "Congenital Malformation of the Heart" *(Taussing, 1947)*.

Since the time of Galen in the second century A.D., scientists have inserted catheters into arteries and veins to study the circulatory system.

Air and water were pushed into cadaver aortas in an attempt to understand the workings of the cardiac valves. *(Cournanad, 1964)*.

The catheters then were hollow reeds or brass pipes and were in common use. When *William Harvey* catheterized the inferior vena cava in a cadaver, he demonstrated that blood flowed toward the lungs, not the periphery, as was then commonly believed *(Comroe, 1982)*.

As frequently happens in the advancement of science, *Wilhelm Roentgen* reported that there is "A New Kind of Rays" and noted that materials of higher density were less transparent *(Roentgen, 1945)*.

One of the most amazing facts about the history of angiocardiography is that the pioneer physicians passed catheters through their own veins to ensure the safety of the technique before subjecting their patients to the same procedure.

In 1912 *Bleichroder* reported that in looking for a way to inject drugs close to the diseased organ in his patients, he underwent venous catheterization. His catheters did not reach the heart but passed into a central location in the inferior vena cava.

Bleichroder also catheterized the femoral artery by direct exposure under local anaesthesia and passed a catheter proximally. Such a technique, he speculated, would be useful

for intra-arterial drug therapy; he also suggested that a catheter with an inflatable balloon at its tip would be useful in controlling haemorrhage, an idea that became a routine part of angiographic practice nearly half a century later. *(Bleichroder, 1912)*.

Werner Forssmann in 1929 passed a catheter from an arm vein into his own right atrium, demonstrating the safety of a catheter lying within the heart. In the following 2 years, Forssmann repeated his self-catheterization four times without complication (except for possible thrombosis of his arm veins which were ligated after each passage). *(Forssmann, 1929)*.

Since these early attempts to demonstrate the intra-cardiac morphology were becoming fruitful, it was time to learn the radiographic anatomy.

Laubry and *Coworkers* used cadaver to develop excellent anatomic detail; in particular, they promoted the use of the right and left anterior oblique projections *(Laubry, 1935)*.

The angiography of congenital heart disease was pioneered by *Castellanos* and *Pereiras*, who working in Havana, developed a technique for children under the age of 2 years, including the new born. *(Castellanos, 1938)*.

Clies was a forerunner of today's selective catheterization techniques; in Mexico city, in 1946, he passed a catheter from the arm vein into the right atrium and directly

injected contrast media within the heart, with a very intense sensation of warmth throughout the whole body *(Clies, 1946)*.

Later, a variety of catheter systems and techniques were developed by Dother and others *(Dother, 1950)*.

Numerous catheter techniques to alter intracardiac or arterial blood flow in certain diseases have been used for nearly two decades.

In 1966, *Rashkind* developed a technique to create an atrial septal defect without thoracotomy. The procedure produced a mixing of oxygenated blood from the left to the right atrium and thereby palliated certain life-threatening congenital defects, such as transposition of the great arteries, tricuspid atresia, and total anomalous pulmonary venous connection *(Rashkind, 1983)*.

Transfemoral catheter closure of patent ductus arteriosus was devised by Porstmann and Coworkers in 1966 *(Porstmann, 1971)*. His technique uses a conical plug which is positioned in the ductus from the aortic side. Successful catheter closure can be achieved provided that the ductus is conical and that the femoral artery diameter is greater than the newest portion of the ductus (so that the plug may traverse it) *(Sato, 1975)*. Transluminal balloon angioplasty has been developed as a non surgical technique for dilatation of stenotic arteries.

The first transluminal recanalization was performed by *Dother* in 1963 when he traversed an occluded iliac artery. *(Dother, 1980)*.

Andreas Gruntzing et al. modified the original technique of Dotter and Judkins by using a double-lumen dilatation catheter with a non elastic balloon. *(Gruntzing, 1979)*.

Refinements of the Gruntzing technique have allowed dilation of coronary stenosis to be performed in many cardiac catheterization laboratories. *(Kent, 1982)*.

Balloon angioplasty has been successfully used in the treatment of patients with stenosis of the coronary and peripheral circulations since 1976. *(Spence, 1981)*.

Recently transluminal angioplasty has been applied in pediatric to treat pulmonary valve stenosis, peripheral pulmonary artery stenosis, coarctation of the aorta, coarctation restenosis, and aortic valve stenosis. *(Kan, 1984)*.

BALLOON ATRIOSEPTOSTOMY

1. BALLOON ATRIOSEPTOSTOMY (B.A.S.)

The initial attempts in animals to produce an atrial septal defect with a catheter device took on several forms. The initial devices were as simple as a bent wire through a large catheter and as complicated as a miniaturized bronchoscopic snare. Devices of this sort did work in animals, but were unreliable because sometimes the defect involved the atrial wall rather than the septum. Ultimately, the decision is made to concentrate on balloon catheters. Early experiments on puppies were difficult because the puppy usually has a sealed atrial septum by the time it is big enough for experimentation. These puppies are subjected to septostomy, and atrial autopsies over a 4 months period showed that all the defects remained open *(Rashkind, 1983)*.

Transposition of the great arteries is a common and frequently lethal congenital cardiac malformation. Among 100 infants with congenital heart disease who died within the first month of life, *Ober* and *Moore* in 1955 found that 27 had transposition of great arteries. Nearly all untreated infants with entity die before 6 months of age, and most of them before 3 months. In the past few years a variety of surgical procedures for correction of this defect have been devised.

In patients beyond 1 year of age and without other associated surgical defects, correction of transposition has been attempted with a mortality of 17 to 29%, when the method