EVALUATION OF BIOLOGICAL TISSUE ADHESIVES IN EXPERIMENTAL OTOLOGIC SURGERY

THESIS

Submitted For Partial Fulfilment Of
M.D.Degree In Oto-Rhino-Laryngology

BY

AHMED ABDEL KHALIK MOSTAFA EL-SAFTY
M.B.,B.CH. M.Sc. (Otolaryng.)
E.N.T. SPECIATLIST
MATARIA EDUCATIONAL HOSPITAL

SUPERVISORS

Prof.Dr.MOHAMED ELKAHKY
Prof. & Head
Of E.N.T. Department
Ain Shams University

Prof.Dr. ADLY FARID
Prof. & Head
of Pathology Department
Ain Shams University

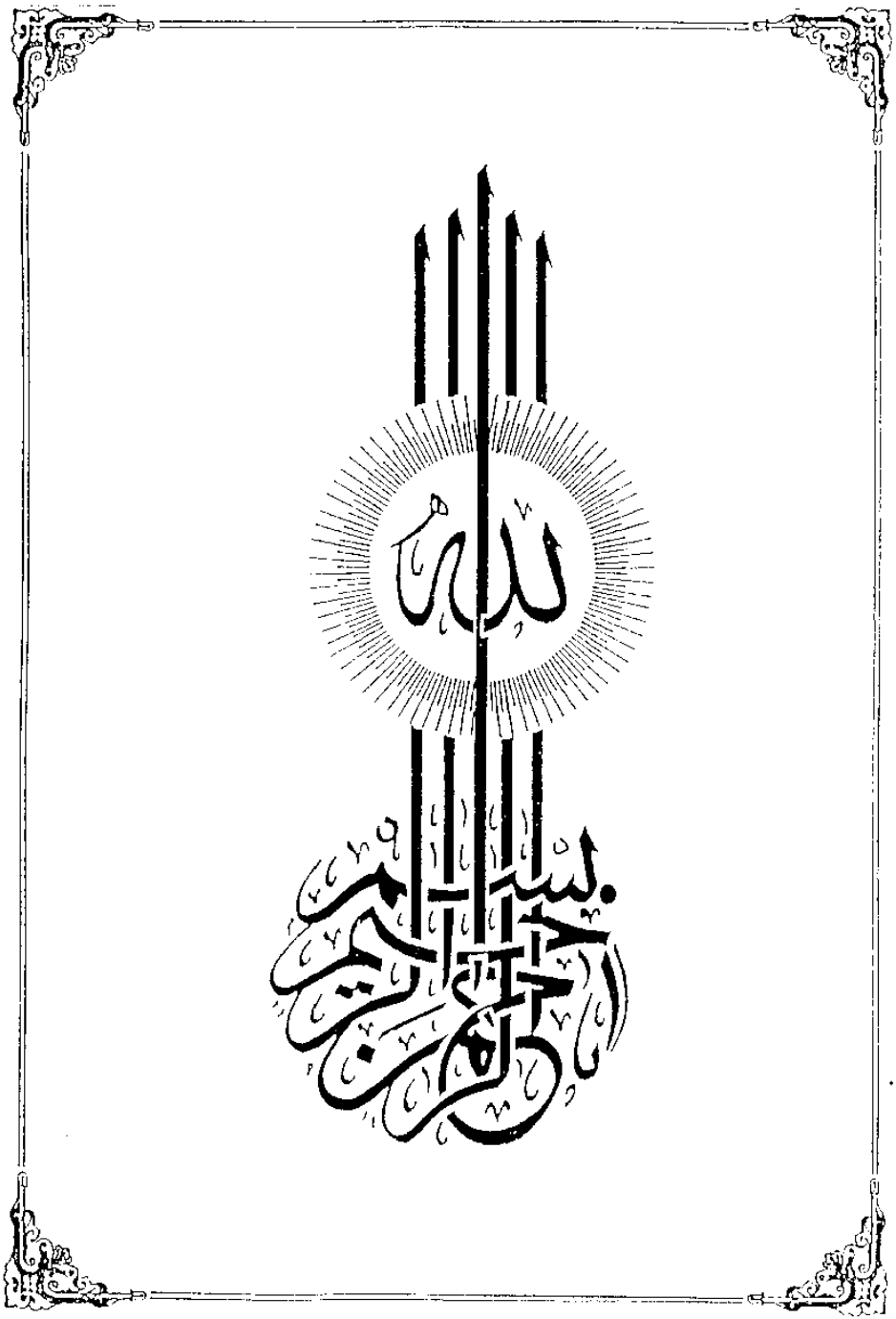
Prof.Dr.ABDEL-REHEIM SARWAT
Prof. of E.N.T.
Ain Shams University

Prof.Dr.HUSSEIN NASR
Head Of E.N.T. Dept.
Materia Educational
Hospital

Prof.Dr.NABIL RABIE
Prof.Of E.N.T.
Ain Shams University

FACULATY OF MEDICINE
AIN SHAMS UNIVERSITY
1991


بسم الله الرحمن الرحيم
وقل اعملوا فسيرى الله عملكم
ورسوله والمؤمنون



LIST OF ABBREVIATION

Index To Abberviations

AIDS	: Acquired Immunodefficiency Syndrome .
A.S.	: Ammonium Sulphate .
Ba.S.	: Barium Sulphate .
Cacl	: Calcium Chloride .
Cm	: Centimeter .
D.W.	: Distelled Water .
FXIII	: The Fibrin Stabilizing Factor . Laki - Lorand Factor.
G.pig.	: Guinea pigs .
g.	: Gram .
g/cm^2	: Gram per Square centimeter
HIV	: Human Immunodefficincy virus
IU	: International Unit .
IU/ml	: International Unit per milliliter.
KIU/ml/	: Kallidogenose-inactivating unit per milliliter.
KPA	: KiloPascal .
mg	: Milligram .
min	: Minute(s) .
mg.S.	: Magnesium Sulphate .
ml	: Milliliter
mm	: Millimeter
mMol	: Millimol .

mMOL/l	: Millimol per liter
M.W.	: Molecular Weight .
NAMRU-3	: Beside fever hospital (Abbasia)
No.	: Number - Nomero .
rpm	: Revolution per minute .
PEG	: Polyethylene glycol .
Sod. Cit.	: Sodium Citrate .
U/l	: Unit per liter
ug	: Microgram .

CONTENTS

***

AKNOWLEDGEMENT

ACKNOWLEDGMENT

I wish to express my deepest gratitude to Prof. Dr. MOHAMED EL-KAHY. Professor and Head of ENT Department, Faculty of Medicine, Ain Shams University, for his patient supervision, generious advices and elaborate suggestions .

I am deeply gratuful to Prof. Dr. ADLY FARID, Profesor and Head of Pathology Department, Faculty of Medicine, Ain Shams University, for his continuous encouragment, constant help and wise advices that helped me too much in this work .

I am deeply indebted to Prof. Dr. ABDEL-REHEIM SARWAT, Professor of ENT, Faculty of Medicine, Ain Shams University, for his constructive supervision and his kind help .

I do highly appreciated to Prof. Dr. HUSSEIN NASR, Consultant of ENT, General Authority for Educational Hospitals and Institutes, for having taken the trouble to supervise me along the steps of this work .

I can hardly express my gratitude for Prof. Dr. NABIL RABIE, Professor of ENT, Faculty of Medicine Ain Shams University for his moral help and his trials to make this work out of troubles .

I wish I could repay Assist. Prof. Dr. HESHAM EL-SHERBENY, Assist. Prof. Dr. HAZEM EL-MOHERY and Assist. Prof. Dr. OSAMA MAHMOUD, ENT dept., Faculty of Medicine , Ain Shams University.

Very many thanks for lecturer of ENT Dr. Mostafa El-Nashar, High Institute for Childhood studies, Ain Shams University and Lecturer of ENT Dr. Hany Riad Faculty of Medicine, Ain Shams University .

INTRODUCTION

INTRODUCTION

Despite numerous advances in the middle ear surgery, repair of middle ear defects resulting from infection or trauma has had limited success. One of the major obstacles preventing more successful repair of these defects is the absence of an adequate method for securing the small pieces of tissues and prosthetic implants used in middle ear reconstruction (Epstein et al., 1986).

Since the dawn of civilization, man has always dreamed of achieving the repair of injured parts of the body merely by "glueing" these parts together. Doctors in Ancient Greece used plant resins in an attempt to repair injuries. The Ancient Egyptians used a kind of adhesive vegetable gum to heal surgical injuries (Lyons and Petrocelli, 1978).

After the synthesis of cyanoacrylates by Ardis (1949) and the discovery of their adhesive properties by Coover et al. (1959), many authors, such as Matsumoto (1968), Leonard (1968), and Yamamoto and Fish (1974) used cyanoacrylates for the anastomosis of nerves. Many authors published articles where they confirmed the

histotoxicity of cyanoacrylates (Ronis et al., 1984 and Vinters et al., 1989) .

The use of substances such as fibrin and fibrinogen, in haemostasis and treatment of wounds, stretches back to World War 1. Fibrin tissue adhesive, compared with other surgical glues such as cyanoacrylates, has the definite advantage of being totally biodegradable (Siedentop et al., 1986). Autologous fibrin tissue adhesive made from the patient own blood has been developed to fill the need for a fibrin tissue adhesive, especially for use in ear surgery and eliminate the transfusion related risks of commercially available adhesive (Wolf 1983). Fibrinogen glue made from the patient 's plasma has been used both with the method described by Wolf, 1983 (AS glue) and the other by Epstein et al, 1985 (PEG). To obtain relative objective data on the properties of these glues in comparison with the commercial product (TISSEL), a series of tests in animals & in vitro was performed.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

PRINCIPLES OF BIOLOGICAL GLUEING

The process of wound healing starts, physiologically, when bleeding ceases. Formation of haemostatic clots takes place at sites where the injured blood vessels remain open. These clots form from platelets, erythrocytes and fibrinogen, and gradually become more solid.

The formation of a fibrin net due to the effect of factor XIII and the retraction of the clot during the ensuing withdrawal of plasma are the subsequent steps in this process. Under the influence of thrombin and calcium, coagulation leads to the conversion of fibrinogen to fibrin (Epstein et al ., 1986) .

The presence of a cell response during the process of coagulation was confirmed. In addition to thrombin and collagen III, platelets complete the process of coagulation (Balliesen et al., 1975). The platelet adhesion to type III collagen fibrils leads to platelet aggregation, a process where platelets turn from their reversible into their irreversible state (Dukert et al., 1978) .

The clot constitutes a primary seal, because of its fibrin contents. Hence, normal haemostatic mechanisms contribute to prevent contamination or loss of organic fluids and to supply cells with the substratum necessary for their growth (Baier., 1972).

The presence of fibrin is essential, since the presence of products stemming from its degradation causes the chemotaxis of local neutrophils (Schlag et al., 1986). This principle has been simulated with the use of an adhesive solution made up of fibrinogen, factor XIII, and other proteins,as well as solution of thrombin and calcium cholride. Once the mixture of both components is completed, fibrinogen is cleaved into fibrin monomers which aggregate to make up a gel.

Concomitantly , thrombin turns factor XIII into factor XIII', which in the presence of calcium ions, forms the active enzyme factor XIIIa. Factor XIIIa triggers the cross - reaction of aggregated fibrin monomers to form a high molecular - weight polymer. Owing to this reaction, both the rigidity and the resistance of the glueing increase. Factor XIIIa also triggers the cross - linkage of fibronectin in the adhesive and presumably that of fibrin and fibronectin