EVALUATION OF ILIZAROV TECHNIQUE IN CORRECTION OF DEFORMITY

Thesis
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M.D. In Orthopaedics

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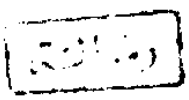

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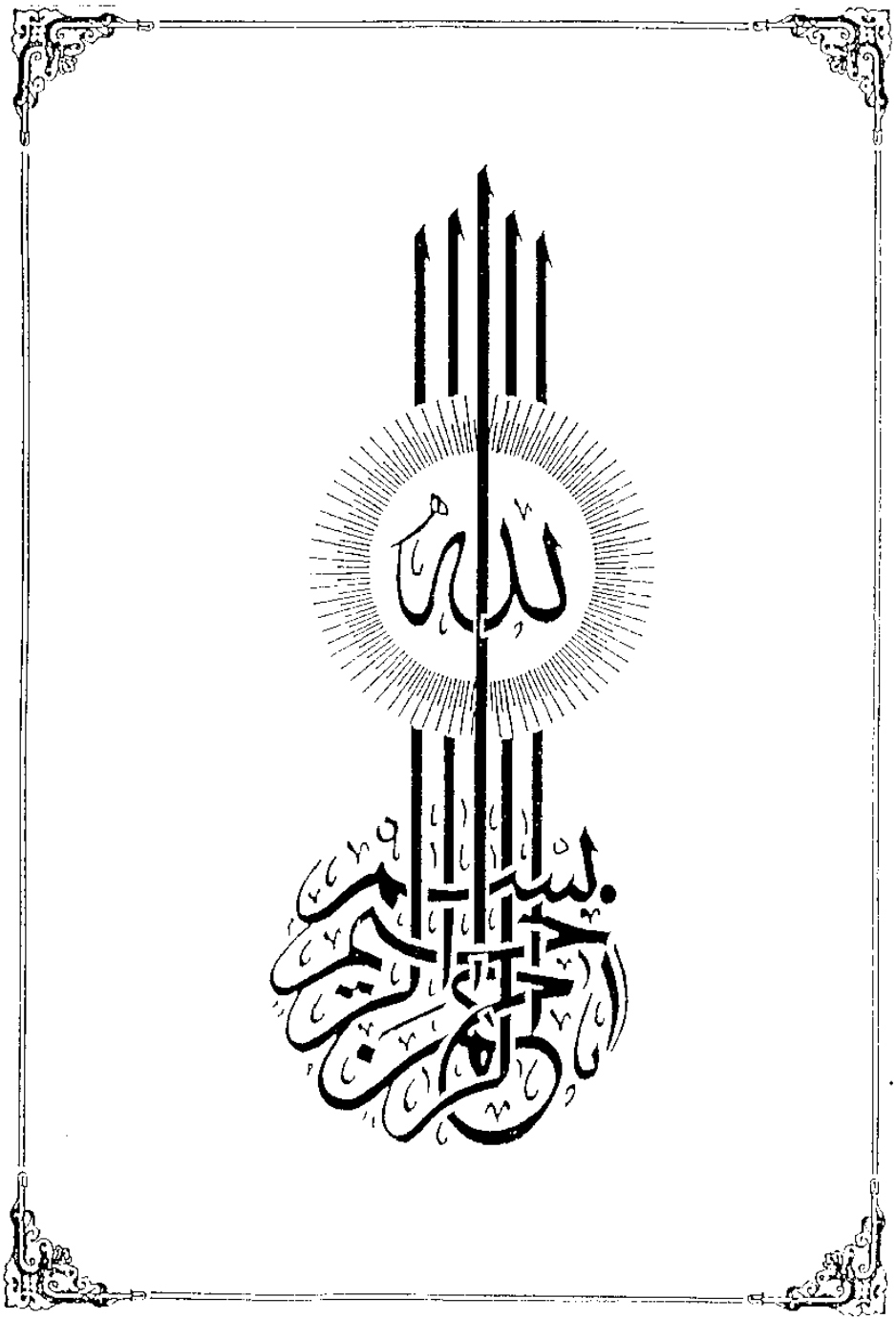
لجنة المناقشة

أ.د. ممدوح زكي سعد ... رئيس ... مشرفاً

أ.د. عبد السلام السيد شريف ... مناقشاً خارجياً

أ.د. احمد زكي السيد ... مناقشاً داخلياً



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CONTENTS

LIST OF TABLES

CHAPTER I

INTRODUCTION AND HISTORICAL REVIEW

Although in use for more than one century, external fixators have been applied with little consistency, with variable results, and with a high rate of complications. There are several reasons for this unfortunate state. First, until recently only a small number of surgeons had developed sufficient interest in and understanding of the method to become comfortable with it, and none of these experts distilled the wealth of observations and experience into a simple, logical body of knowledge that could be easily taught to the next generation. Second, devices with satisfactory clinical features were not available until the late 1930s, and little was known about the mechanical behavior of different fixators and configurations until the past decade. Third, when assessing the worth of external fixators, surgeons have been most interested in the ability of these devices to salvage often difficult clinical problems, yet this focus on the unusual and dramatic advancement has obscured device-induced injuries and side effects and delayed the search for safer and more effective frames. The lack of clear terminology and a logical classification of different devices and configurations has also hampered communication and prevented the recognition of unifying concepts. Finally, since World War II, external fixators have developed in two directions. In the West most surgeons favor simple, sturdy, unilateral constructs with low profiles, and easy limb access whereas in Eastern Europe the highly adjustable Ilizarov external fixator was the one of choice ***(Behrens, 1989)***.

Professor Ilizarov, the recipient of the 1978 Lenin Prize for Medicine, is considered a hero of Socialist Work. As an Emeritus Professor and an

Inventor Emeritus of the U.S.S.R., he recently achieved full membership in the Soviet Science Academy, a rare honor for a doctor of medicine.

Ilizarov began his work more than 35 years ago in Kurgan which is situated on the western border of the immense Siberian state, some 3,000 kilometers east of Moscow. In this small industrial city (of 250,000) Professor Ilizarov first conceived his method in 1951. It is said that one patient accidentally turned the connecting rods between rings in distraction rather than compression. Ilizarov observed new bone formation radiographically following this distraction. Recognizing the potential significance of this observation, he initiated a series of experimental work in animals.

His phenomenal accomplishments, only recognized in the Soviet Union during the last 10 years, received only scant attention in western journals ***(Bianchi et al., 1991)***.

This treatment method is currently used by a majority of the hospitals in the Soviet Union, where it is estimated that close to one million patients have been treated using this modality. In the past few years, the use of this method has diffused beyond the boundaries of the U.S.S.R. Italy can be considered the first western country to begin clinical trials which started in 1981 ***(Hammer et al., 1987)***.

When Ilizarov was invited to the XXII Italian AO Meeting in Bellagio, Italy, in June 1981. It was there, under the chairmanship of Professor Roberto Cattaneo, Chief of Orthopaedics and Traumatology of the Lecco General Hospital, that Ilizarov participated in his first western conference. The subject of the conference was "Prophylaxis and Treatment of Bone Infection." Ilizarov presented three major topics:

1- "The Treatment of Open Fractures".

2- "The Treatment of Post-Traumatic Osteomyelitis".

3- "Bone Lengthening".

In July 1981, Professor Cattaneo and his associates, A. Villa, M.D., M. Catagni, M.D. and L. Tentori, M.D., began their first clinical trials with transosseous osteosynthesis as described by Ilizarov using a complete set of instruments for construction of the apparatus, donated by Ilizarov to the Lecco General Hospital.

The impact of this method, illustrated by Ilizarov himself at the Bellagio meeting in 1981 was impressive to the extent that the Italians organize **A.S.A.M.I.**, the Association for the Study and Application of the Methods of Ilizarov ***(Lecco, 1981)***. As its first order of business, the association, with Cattaneo as president, organized the first course on The Theoretical and Practical Application of Ilizarov's Methods held in Longone al Segrino, Lecco, in June 1983. The course was directed by Ilizarov and his assistant, Dr. V. I. Shevtsov. There were over 300 participants among which were two honored guests, Augusto Sarmiento, M.D., and G. Dean MacEwen, M.D., from the United States.

From 1983 to 1985, the Ilizarov method has spread rapidly through most of western Europe as a result of the **A.S.A.M.I.** organization in Italy. On February 1, 1985, Ilizarov participated in the "Fin de semana Traumatol´gico-Ortopédico" in Spain, at the "Ram´n and Cajal" Centre, as organized by Professor J. de Palacios y Carvajal. On February 4, 1985, in Barcelona, he also attended the meeting, "A Day on the Indications and Methods of the Ilizarov Technique," held at the San Rafael Hospital and directed by Professor Viladot. In October of that year, the first French Course on the "Theoretical

and Practical Aspects of the Ilizarov Technique" was held in Strasbourg, organized by **M.D.B.** Briot of the "Traumatology and Orthopaedics Center" directed by Professor I. Kempf. Later that month, other meetings were given at the University of Milan and at the "Bambin Gesu" Pediatric Hospital in Rome.

Many courses have since been organized in different cities of Italy, Portugal, Switzerland, France, Spain, Greece, Brazil and the united States. regularly scheduled courses for orthopaedic surgeons are currently held at both the Lecco and Bergamo General Hospitals.

This method is now used in many western nations and, more recently, the United States and Canada. Based on a 1987 poll, the number of European hospitals using the method included: Italy, 175; Spain, 80; France, 117; Portugal, 5; West Germany, 8, and Greece, 5, with more than 6,000 cases treated. **A.S.A.M.I.** groups have been founded in France, Spain, Belgium, Portugal and Brazil to allow a joint effort in the advancement of scientific and clinical knowledge on this subject.

Ilizarov methodology marks the beginning of new and extremely original scientific and practical concepts which have allowed the enunciation of new, previously unknown biologic laws regarding bone formation, osteoinduction and tissue neogenesis. Currently, the fundamental impetus of his Institute is the theoretical study and practical application of this new method of transosseous osteosynthesis in orthopaedics and traumatology ***(Bianchi et al., 1991)***.

CHAPTER II

GENERAL PRINCIPLES AND TYPES OF EXTERNAL FIXATOR

A- GENERAL PRINCIPLES AND BASIC CONCEPTS OF EXTERNAL FIXATION

(The majority of this chapter is discussed after Behrens (1989))

The ongoing analysis of fixator complications has led to a better understanding of the underlying causes and has brought about new remedies. The recognition of the importance of thorough preapplication long-term planning and of the need to adhere to the basic concepts while applying external fixators, has been crucial in resolving many and controlling most of the annoying fixator-related problems.

CAPABILITIES

External fixators have a number of unique capabilities that distinguish them from other methods of bony fixation: (1) skeletal stabilization at a distance from the site of injury, disease, or deformity; (2) free access to an injury site for primary or secondary procedures; (3) great versatility in accommodating a wide variety of bone and soft-tissue lesions, including the ability to stabilize injuries extending across two or more adjacent limb segments; (4) adjustability of alignment, length, and mechanical properties after the device has been applied; (5) ability to use simultaneously and/or sequentially internal fixation and other methods of skeletal stabilization; (6) minimal interference with adjacent joints; and (7) mobilization of limb and patient, including full weight bearing ***(DeBastiani et al., 1984)***.

PLANNING

Planning starts before the fixator is applied and ends when the injuries are healed and the patient is rehabilitated.

The initial assessment considered the patient's age, size, and premorbid condition and the cause, severity, and extent of the injuries. This evaluation should answer the following questions. Is external fixation the best method for treating the patient's injuries?.

What is the best device? Should the fixator be used alone or with internal fixation? Is there the necessary equipment, knowledge, and skills? Should the full-frame be applied immediately, or would it be possible to wait for more advantageous conditions to apply or complete the fixator? Will the fixator remain until the bone is healed, or would it be better replaced with a cast or internal fixation as soon as the soft-tissue conditions permit?.

INDICATIONS

The two main groups of fixator indications, severe traumatic musculoskeletal injuries and major alignment and length deficit, require fixators that at this time have mutually exclusive design features.

Severe traumatic limb injuries are best managed with simple, sturdy unilateral frames. The best locations for pins and frame are determined by the nature, size, severity, and inherent stability of the injury, as well as the injury's relationship to the safe or hazardous corridors. Thus, for each injury, the frame is specially adapted to optimally accommodate access routes, repeated debridement, the transfer of local and distant soft-tissue flaps, and the application of a bone graft or internal fixation.