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NEUROLOGY BOARD REVIEW MANUAL

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Treatment of Acute Ischemic Stroke

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Table of Contents

Introduction.....	2
Nonspecific Therapies	2
Acute Antithrombotic Therapy	4
Acute Thrombolytic Therapy	5
Treatment of Severe Brain Edema	9
Experimental Therapies	10
Case Patients	11
Summary Points	12
References.....	12

Cover Illustration by Craig Zuckerman

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Treatment of Acute Ischemic Stroke

Steven K. Feske, MD

I. INTRODUCTION

Therapy for acute ischemic stroke has advanced rapidly in the last decade. Before the mid-1990s, acute therapy in clinical practice still revolved around the optimal application of antithrombotic therapies and the provision of supportive care for stroke complications. Carefully designed studies to investigate the use of thrombolytic therapies were carried out in the late 1980s and early 1990s. These studies led to the publication in December 1995 of the first successful trial of a thrombolytic agent (ie, recombinant tissue plasminogen activator [rt-PA]) for acute ischemic stroke.¹ The success of this work has been transferred to clinical practice. Much work has been done to refine the indications and use of this therapy. Another line of investigation has sought to apply various neuroprotective agents to the treatment of acute stroke; however, this work has not yet produced a clearly effective therapy.

This article will review the current status of therapy for acute ischemic stroke emphasizing the application of intravenous and intra-arterial thrombolytic therapy. Two case patients are presented to highlight essential features of therapy for acute ischemic stroke. The diagnosis of acute ischemic stroke was discussed in the first article of this volume, "Diagnosis of Ischemic Stroke" (*Hospital Physician Neurology Board Review Manual*, Volume 7, Part 1).

II. NONSPECIFIC THERAPIES

Patients with acute ischemic stroke should receive nasal oxygen as well as treatment for fever, hyperglycemia, dehydration, and active cardiovascular problems, such as congestive heart failure and cardiac arrhythmia. Although such therapies have not been shown to be effective, these therapies are generally safe; their application is based on an understanding of physiologic principles, extrapolation from animal studies, and data from patients with various disorders. Management of blood pressure in the acute situation is more complex and is discussed in the next section.

BLOOD PRESSURE MANAGEMENT

There are 2 competing goals for the management of blood pressure in patients with acute ischemic stroke. Concern for focal cerebral perfusion suggests maintaining elevated blood pressures; however, concerns for hemorrhagic conversion, edema, and medical complications suggest lowering excessively elevated pressures. Brain tissue perfusion depends on cerebral blood flow (CBF), which varies according to the following relationship:

$$\text{CBF} = (\text{CPP})/(\text{CVR}), \text{ where CPP} = \text{cerebral perfusion pressure, and CVR} = \text{cerebrovascular resistance.}$$

$$\text{CPP} = (\text{MAP}) - (\text{CVP}), \text{ where MAP} = \text{mean arterial pressure, and CVP} = \text{central venous pressure.}$$

In the setting of focal cerebrovascular stenosis or occlusion, vascular resistance is greatly increased at the site of the vascular lesion causing a critical drop in focal CBF. Under these conditions, regional autoregulation is lost and regional perfusion is dependent on arterial blood pressure.² Also, many patients with acute stroke have underlying hypertension causing a shift in the autoregulation curve such that loss of autoregulation and passive blood pressure dependence begin at a higher mean pressure.³ This loss of perfusion can be offset in part by increasing the MAP and thus the CPP. Therefore, in the setting of acute cerebral ischemia, it is desirable to maintain a high MAP to enhance direct and collateral perfusion of the area at risk.⁴

The American Heart Association has published guidelines for management of blood pressure in acute stroke.^{5,6} Recommendations for a threshold above which to treat elevated blood pressure are based on physiologic understanding, but they have not been validated in controlled studies. The main principle is to avoid overtreatment of high blood pressure in order to allow maximal perfusion past a fixed stenosis or via collateral vessels around such a focal stenosis or occlusion. Situations in which blood pressure should be decreased include certain medical conditions (eg, aortic dissection, acute myocardial infarction [MI]) and evidence of a hypertensive urgency (eg, encephalopathy, papilledema, heart failure, renal failure). When none of these