Role of venotomy in the prevention of reperfusion injury in late cases of acute lower limb ischemia

Thesis
Submitted for fulfillment of the Master Degree
in general surgery

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2011

Acknowledgement

*Thanks first and last to **Allah** as we owe him for his great care, support and guidance in every step in our life.*

*I'd like to express my respectful thanks and profound gratitude to **Prof. Dr. Hussein Mahmoud Khairy**, professor of general and vascular surgery, Faculty of Medicine, Cairo University, for giving me the honor and great advantage of working under his supervision. His valuable teaching and continuing education to me extend far beyond the limits of this thesis.*

*My sincere thanks and utmost appreciation are humbly presented to **Dr. Karim Adel Hosny**, lecturer of general and vascular surgery, Cairo University, for his meticulous supervision, professional experience and tremendous assistance. I really appreciate his patience and support.*

Special thanks to all teaching staff, and my colleagues in the department of surgery for their continuous and endless encouragement and respect.

I thank every one who gave a hand of help, advised for or just hoped the success of this work.

My deepest gratitude I extend to my whole family who offered me support, advice and motivation.

Abstract

Revascularization of an acutely ischemic limb may lead to the development of a reperfusion syndrome, characterized by acidosis, hyperkalemia, myoglobinuria, and disseminated intravascular coagulation. We evaluated the components of the femoral venous efflux after reperfusion of an acutely ischemic limb in fifteen patients and compered the result with the components of the femoral venous efflux after reperfusion of an acutely ischemic limb in another fifteen patients as a control group.

Our study shows that the duration of ischemia is directly related to the severity of systemic hyperkalemia, systemic acidosis and serum level of creatine phosphokinase. The more prolongation in the duration of acute ischemia the more severe degree of systemic acidosis and hyperkalaemia produced by the ischemic tissue.

The levels of the postoperative serum potassium and serum CPK were lower in the study group than the control group, which shows that venous drainage prior to revascularization in late cases of acute lower limb ischemia may ameliorate the ischemia-reperfusion injury.

Keywords:

Acute limb ischemia

Reperfusion

Venous drainage

Dedication

To my family, especially my parents, for their encouragement, patience, and assistance over the years. And to my brothers, and sisters.

Contents	Pages

List of figures

List of tables

Abbreviations

ALI	Acute limb ischemia
ASIS	Anterior superior iliac spine
CDT	Catheter-directed thrombolysis
CPK	Creatine phosphokinase
IPC	Ischemic preconditioning
IRI	Ischaemia-reperfusion injury
MODS	Multiorgan dysfunction syndrome
PAOD	Peripheral arterial occlusive disease
PMT	percutaneous mechanical thrombectomy
rt-PA	recombinant tissue plasminogen activator
SIRS	systemic inflammatory response syndrome
STILE	Surgery versus thrombolysis for ischemia of the lower extremity
TOPAS	Thrombolysis or Peripheral Arterial Surgery
VEGF	vascular endothelial growth factor

Introduction

Acute ischemia of the limb represents one of the toughest challenges encountered by vascular specialists. The diagnosis and initial assessment are largely clinical, and diagnostic errors can result in a high price to the patient—amputation or even death. Amputation and death rates remain high despite intervention, which is in contrast to major advances in the treatment of many other vascular diseases. Acute ischemia is often an end-of-life condition that presents in a patient with multiple medical co-morbidities. Therefore, careful clinical assessment of the individual is as important as assessment of the limb **(Jonothan & Earnshaw, 2010).**

Unlike many other vascular conditions, there is no one definitive treatment; a variety of modalities are available, including anticoagulation, operative intervention, thrombolysis, and mechanical thrombectomy. Selection of the most appropriate intervention or combination of interventions can be critical to the eventual outcome. **(Jonothan & Earnshaw, 2010).**

Revascularization of ischemic tissue is clearly necessary for its preservation, although it is becoming increasingly apparent that this may be associated with a series of pathological events that may culminate in irreversible injury to that organ and systemic organ dysfunction**. (Homer & Granger, 2005).**

In patients with acute ischemia the threat is not only to the limb, but these patients are also at a high risk for death. Limb hypoperfusion results in systemic acid-base and electrolyte abnormalities that impair cardiopulmonary and renal function. Ischemic and reperfusion injury of the extremities may result in a systemic, severe and complex metabolic syndrome, manifested by acute renal failure, myoglobinuria, metabolic acidosis, hyperkalaemia and free radicals releasing. Successful reperfusion may result in the release of highly toxic free radicals further compromising these critically ill patients. **(Peter et al, 2010).**

Acidosis and hyperkalemia result from the washout of accumulated byproducts of anaerobic metabolism. The factors responsible for the development of reperfusion injury are the toxic metabolites of molecular oxygen such as superoxide radicals and hydroxyl radicals. The electronic configurations of these free radicals are highly unstable, and they react with other molecules to stabilize rapidly; however, in so doing, they cause structural and functional changes in cell membranes and organelles, resulting in their disruption. Many of these reactions result in the further release of free radicals, which, by themselves, are capable of propagating this process **(Padberg & Duran, 2009).**

The treatment of the patient with an ischemic lower limb should be immediate anticoagulation in the absence of any significant contraindication. Early intervention is important to the limb **(Peter et al, 2010).**

Aim of the work

The aim of this work is to detect the value of a venotomy during revascularization in ameliorating the reperfusion injury in late cases of lower limb ischemia. Furthermore the correlation between the duration of acute ischemia and the degree of systemic acidosis and hyperkalaemia produced by the ischemic tissue was evaluated.

Literature review

Anatomy

Arterial system of the lower limb

Femoral artery:

The femoral artery, the continuation of the external iliac artery distal to the inguinal ligament, is the primary artery of the lower limb. It enters the femoral triangle deep to the midpoint of the inguinal ligament (midway between the ASIS and the pubic tubercle), lateral to the femoral vein. The pulsations of the femoral artery are palpable within the triangle because of its relatively superficial position deep (posterior) to the fascia lata. It lies and descends on the adjacent borders of the iliopsoas and pectineus muscles that form the floor of the triangle.

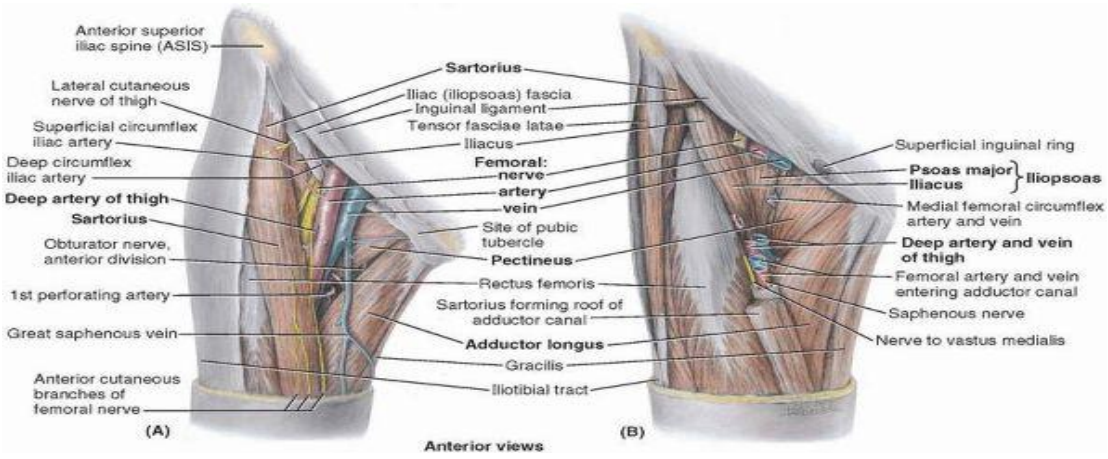

Fig. (1) Femoral triangle. (Moore et al, 2010).

The superficial epigastric artery, superficial (and sometimes the deep) circumflex iliac arteries, and the superficial and deep external pudendal