GENERAL AND SYSTEMIC BODY EFFECTS AFTER MAJOR ARTERIAL SURGERY

ESSAY

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INTRDUCTION

INTRODUCTION

Surgery of the aorta and its major branches is now a common occurance in operating theatres throughout the world. Innovative surgical techniques. Advances in anesthesia and patient monitoring, and better understanding of vascular pathophysiology and the factors that influence outcome of surgical intervention now permit operative procedures once associated with prohibitive risk to be performed safely. While these developments have clearly established vascular surgery as a recognised subspeicalty, they also require an increasingly specialized focus by anesthesiologists on the problems that distinguish management of vascular operations from that of most other types of surgery.

[Sabawala PB, et al.,1970]

Such problems include:

1. Impairment of vital organ perfusion by pre-existing vascular disease and/or intraoperative vascular corss-clamping.

2. Major physiologic insult resulting from extensive retroperitoneal dissection, or dissection about the thoracic aorta, collapse of lung, and one lung ventilation.

3. Hydraulic stress to the left ventricle produced by corss - clamping the aorta, during aortic surgery.

4. Risk of sudden or profuse perioperative hemorrhage .

5. Adverse circulatory and hematologic changes that can result from massive blood transfusion.

General improvement in anesthetic care and the intraoperative management of these problems have made important contributions to the greater safety of major vascular surgery.

[Diehl JT, et al., 1983]

Patients undergoing vascular surgery are usually older, often in the sixth to ninth decade of life. The prevelance of coexisting hypertension, coronary artery disease, and chronic pulmonary or renal disease in patients with acquired vascular disease is well documented. Preoperative evaluation and preparation of the vascular surgical patient comprises the task of identifying, quantifying, and modifying where possible risk that arises from coexisting disease and organ dysfunction.

[Thompson JE, et al., 1980].

The purpose of this essay is to review the most commonly performed major arterial procedures and the physio-pathologic effects of such major surgery on the already fragile patients.

The Study Includes :

1. A brief physiological overview of the cardiovascular system.

2. General classification of the different arterial diseases presenting to the vasculr surgeon with emphasis on the types which require major surgical interference.

3. Description of the most commonly performed major vascular procedures and necessary monitoring.

4. Common associated systemic diseases in vascular patients.

5. General and systemic body effects after major arterial surgery and their managmenet.

PHYSIOLOGY

A. PHYSIOLOGY OF THE CARDIOVASCULAR SYSTEM:

The blood vessels are a closed system of conduits that carry blood from the heart to the tissues and back to the heart. Some of the interstitial fluid enters the lymphatics and pass via these vessels to the vascular system. Blood flows through the vessels primarily because of the forward motion imported to it by the pumping of the heart, although in the case of systemic circulation, diastolic recoil of the walls of the arteries, compression of the veins by skletal muscles during exercise, and the negative pressure in the thorax during inspiration also move the blood forward. The resistance to flow depends to a minor degree upon the viscosity of the blood but mostly upon the diameter of the vessels, principally the arterioles. The blood flow to each tissue is regulated by local chemical and general neural and humoral mechnisms that dilate or constrict the vessels of the tissue.

[William F. Ganong, 1991].

* Arteries and Arterioles :

The walls of all arteries are made up of an outer layer of connective tissue, the adventitia; a middle layer of smooth muscle, the media ; and an inner layer, the intima, made up of the endothelium and underlying connective tissue. The wall of the aorta and other arteries of large diameter contain a relatively large amount of elastic tissue. The walls of arterioles contain less elastic tissue but more smooth muscle. The muscle is innervated by noradrenergic nerve fibres, which are constrictor in function, and in some instances by cholinergic fibres, which dilate the vessels.

* *Capillaries :*

The arterioles divide into smaller muscle-walled vessels, sometimes called metarterioles, and these in turn feed into capillaries. A metarteriole is connected directly with a venule by a capillary throughfare vessel, and the true capillaries are an anastomosing network of side branches of this throuhgfare vessel. The opening of the true capillaries are surrounded on the upstream side by minute smooth muscle precapillary sphincter. The true capillaries are about 5 μm in diameter at the arteiral end and 9 μm in diameter at the venous end.

The walls are about 1 μm thick, are made up of a single layer of endothelial cells. The structure of the walls varies from organ to organ, the junction between the endothelial cells permit the passage of molecules up to 10 nm in diameter. The capillaries drain via short collecting venules to the venules.

* ***Lymphatics :***

The lymphatics drain from the lungs and from the rest of the body tissues via a system of vessels that coalesce and eventually enter the right and left subclavian vein at their junctions with the respective internal jugular veins. The lymph vessels contain valves and regularly traverse lymph nodes along their course.

* ***Arteriovenous Anastomoses :***

There are short channels that connect arterioles to venules, by passing the capillaries. These arteriovenous [A-V] anastomosis, or shunts, have thick, muscular walls and are abundantly innervated, presumably by vasoconstrictor nerve fibres.

* ***Veins and Venules :***

The walls of the venules are only slightly thicker than those of the capillaries. The walls of the veins are also thin and easily distended.
They contain relatively little smooth muscle, but considerable vasoconstriction is produced by activity in the noradrenergic nerves to the veins and by chemical agents such as norepinephrine.

The intima of the limb veins is folded at intervals to form venous valves that prevent retrograde flow. There are no valves in the very small veins, the great veins, or the veins from the brain and viscera.

[William F. Ganong, 1991].

B. PHYSIOLOGY OF THE ARTERIAL OCCLUSION:

Although arterial occlusion has many causes, the basic physiologic changes that occur and accompany the obstruction are quite similar. The large and the medium sized arteries serve principally as distributing conduits, while their branches and smaller arteries supply the blood to the various nutritive arteriolar and capillary networks. Vessels branching from the major channels assume a critical and somewhat different role when their parent artery becomes narrowed or occluded. Under such circumstances these distributing branches not only continue to supply their own capillary beds but also redirect the blood arround the diseased segments.

[Strandness DE Jr., 1984].

Longland, divided the collateral arteries into three major segments. The stem or exit vessels are those branch arteries located proximal to narrowed or occluded segment. The direction of flow in these arteries is entirely normal. The stem vessels anastomose with a mesh of smaller intermediate vessels referred to as the "midzone" arteries.

Flow through these vessels as they communicate with their distal and third group of arteries is reversed. The midzone arteries unite with arteries of large size in which the blood flow is reversed. This third and last component has been termed "the reentry channel". Depending upon the location of the stenosis or occlusion, a branch vessel may serve either as a stem or a reentry channel to provide blood to the distal limb. These three major components of the collateral artery network are preexisting vessels that are immediately available to assume this new transport role.

[Longland CJ, 1953].