Vascular Replacement and Anastomosis While Maintaining Continuous Blood Flow*

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INTRODUCTION

 INTERRUPTION OF THE CIRCULATION TO important organs such as the brain, spinal cord, and kidneys, for relatively short periods of time may result in irreversible cerebral damage, paresis of the lower limbs and anuria. Vascular resection and graft replacement should be completed within the time limit or circulation to the vital organs must be maintained in some other way, such as temporary shunting techniques with or without the use of hypothermia or a pump. This is also true for peripheral vessels affected by obliteratorive atherosclerotic changes with impaired blood supply to the organ. Interruption of the circulation to poorly supplied organs, even within the proposed time limit, may be complicated by gangrene.

New clamps and special tubes have been devised that may be applied to any vessel. Vascular replacement and graft anastomosis can be performed while maintaining continuous flow. Interruption of the blood supply to the organ is brief, averaging one to three minutes, while the prosthesis is applied or removed.

EXPERIMENTAL METHOD

Apparatus

The method employed in this procedure makes use of a special prosthesis (Fig. 1) and consists of: (1) two ring vascular clamps, based on the principle of multiple pressure points. This applies the necessary pressure needed to prevent leakage of blood around the tube, without traumatizing the vessel wall; (2) a metallic stainless steel tube with furrows at each end. The ring clamp will close completely only if the teeth are lodged in the furrows.

Procedure

The left thoracic cavity is entered through the sixth intercostal space. The lung is retracted medially and the descending thoracic aorta is exposed. The upper seven intercostal arteries are dissected free, doubly ligated and divided. A straight Potts clamp is applied proximally and another distally with complete interruption of the blood flow and a segment of the aorta is excised.

Figure 1: Showing (A) the metallic tube with the Teflon graft occupying the central portion, (B) the metallic tube within the grasp of the ring vascular clamp, (C) end view of the ring vascular clamp showing the serrated ring which will close completely if applied around the groove of the tube.

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The metallic tube, around which the Teflon graft has been mounted in such a way that the graft will occupy the central portion of the tube, is then applied. The end of the tube is passed through the cut end of the aorta and the ring clamp secured in place around this vessel. The same procedure is applied distally. The distal and proximal Potts clamps are then removed, allowing the blood to flow through the tube. The Teflon graft is anastomosed to the aorta using three interrupted stitches followed by continuous running 5-0 silk sutures. The whole circumference is sutured except for one-third, anteriorly, either proximally or distally depending on the favorable location at the time when the tube is removed. Two Potts clamps are applied, one proximally and one distally with complete occlusion of the blood flow and the ring clamps are removed. The metallic tube is grasped with a Kocher clamp and extruded through the unsutured opening. The remaining portion of the unfinished anastomosis is then sutured using continuous silk. The distal Potts clamp is now removed resulting in retrograde flow of blood proximally. This allows any air at the graft site to pass through the Teflon mesh and prevents air embolism distally. The proximal Potts clamp is then removed.

Results

Experiments were made on 17 mongrel dogs (Table 1). One dog died from empyema and fulminating sepsis and another from bilateral pneumothorax. Postmortem examination of both dogs showed the graft to be patent and the sutures in good position. The remaining 15 dogs did very well postoperatively and were sacrificed from two weeks to five months following surgery. They behaved normally and presented no signs or symptoms of neurologic or vascular

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Vascular clamps and ligature
denudation through the opening. (C) The same view after the completion of the resection and Teflon graft replacement with the special

Figure 2: (A) Showing the descending thoracic aorta mobilized and two pairs clamps applied; one proximally and one distally. The luma
complications. ECG and EEG findings were normal during and after the completion of the procedure. Aortograms (Fig. 3) showed the graft to be in excellent position, without narrowing or distortion at the anastomosis site and with perfect flow distally.

**Discussion**

The results of resection and Teflon graft replacement of the descending thoracic aorta using a special apparatus consisting of a metal tube and ring vascular clamps compare favorably with the experimental reports in the literature using more complicated methods. Anastomosis can be accomplished while maintaining a continuous flow during the procedure except for a very brief period, averaging from one to three minutes, without resorting to a bypass procedure or hypothermia.

This technique can shorten the operating time, plus the fact that end-to-end anastomosis is definitely superior to a bypass procedure. This method may be applied to other parts of the vascular tree by using the appropriate size tubes and ring clamps.

**Summary**

A method is described for the resection and Teflon heterograft replacement of the thoracic aorta in dogs, using specially constructed tube and ring vascular clamps in conjunction with brief interruption of the circulation. The method was used in 17 dogs. Fifteen dogs were followed up for periods of two weeks to five months following the procedure. When sacrificed, no physiologic, neurologic, or cardiovascular impairment was evident on ECG, EEG, and other examinations.

**Resumen**

Se describe un procedimiento para la resección y la sustitución por un heteroinjerto de Teflon en la aorta torácica de perros, usando un tubo especialmente fabricado y pinzas vasculares en anillo en combinación con una interrupción breve de la circulación. El método se usó en 17 perros. Quince de esos perros se pudieron observar desde dos semanas hasta cinco meses. Cuando se sacrificaron no se encontró trastorno alguno, ya sea fisiológico, neurológico o cardiovascular, por medio del ECG, el EEG y otros exámenes.

**Resumé**

Description d’une méthode chez le chien pour la résection et le remplacement de l’aorte thoracique par une hétérogreffe en Teflon, en utilisant un tube préparé à l’avance et des clamps vasculaires en anneaux, avec une brève interruption de la circulation. La méthode a été utilisée chez dix-sept chiens. Quinze chiens ont été suivis pendant des périodes de deux semaines à cinq mois après l’expérience. A l’examen anatomique, il n’y avait pas de désordre physiologique, neurologique ou cardio-vasculaire, ceci d’après l’électrocardiogramme, l’électroencéphalogramme et d’autres examens.

**Zusammenfassung**

Beschreibung einer Methode für die Resektion und den Ersatz der thorakalen Aorta durch ein heterologes Teflonrohr bei Hunden; benutzt wurde eine besonders konstruierte Röhre und ringförmige Gefäßklemmen in Verbindung mit einer kurzen Kreislaufunterbrechung. Das Verfahren wurde bei 17 Hunden angewandt. 15 Hunde konnten 2 Wochen bis 5 Monate nach diesem Eingriff kontrolliert werden. Bei der Sektion ergaben sich keine physiologischen, neurologischen oder cardiovasculären Schä digungen im ECG, EEG und anderen Untersuchungsverfahren.
REFERENCES


PULMONARY HAMARTOMAS

Ten cases of pulmonary hamartoma were submitted to surgery. One patient was only explored. Resection was performed on nine, enucleation in times with calcified or ossified tumors, in one. Moreover, some have been seen to undergo malignant transformation. Despite the slow growth of the tumors, they attain considerable size in some cases and cause bronchial compression which is capable of causing various symptoms of obstruction and infection of the pulmonary area involved. All of these considerations confirm the desirability of making a surgical exploration of presumably benign radiologic shadows and of proceeding to their extirpation. Pulmonary resections are justifiable for large-sized tumors occupying a large part of a lobe or when there exists doubt as to its nature.


INDICATIONS FOR ESOPHAGECTOMY AND ESOPHAGOCAPOPLASTY

Among the benign esophageal disorders for which modifications of esophagectomy and esophaecoaplasty are appropriately adaptable are: corrosive strictures, congenital esophageal atresia, esophageal varices, benign tumors, tracheoesophageal fistula and reflux esophagitis. Treatment of esophageal carcinoma for cure or palliation by supervoltage irradiation therapy and subsequent total esophagectomy with esophaecoaplasty appears to be an improved method of approach. The plan is modified for each patient according to the level of the lesion, regional status of the neoplasm, distant metastases, systemic effects of the neoplasm, and general physical condition. Operative excisional therapy is recommended for all patients except those who are desperately ill, those having nonresectable regional or distant esophageal carcinoma, or those suffering severe cardiac, pulmonary, hepatic, renal or other complicating disorders. Vigorous attention must be given to correcting malnutrition which is the outstanding factor affecting risk status.


EMPHYSEMA IN PREMATURITY INFANTS

Eight premature infants in an outbreak of respiratory illness had clinical and x-ray findings suggesting the term cystic emphysema. A nonhemagglutinating Type 19 ECHO virus was isolated from the tissues in the single fatal case although neutralizing antibodies to that agent were not detected.