Use of aorto-distal aorta shunt during repair of descending thoracic aortic aneurysms.

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**Objective**: To study the results of using aorto-distal shunts for repair of descending thoracic aortic aneurysms.

**Design**: Retrospective study

**Setting**: Cardiothoracic Surgical Unit, Department of Surgery, Chulalongkorn Hospital.

**Subjects**: Thirteen patients were operated on from 1993 to June 1996 for descending thoracic aortic aneurysms using aortic-distal shunts to perfuse the lower body during aortic clamping. We used a simple shunt made from tubing used in open heart surgery and with low doses of systemic heparin.

**Main outcome**: Complications and mortality with emphasis on the incidence of acute renal failure, paraplegia and postoperative bleeding.

**Results**: There were no acute renal failure requiring dialysis or paraplegia among the thirteen patients. The one death was due to postoperative cerebral hemorrhage. There were also no complications related to use of shunt. There was no excessive postoperative hemorrhages.

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Conclusion: The aortic-distal aorta shunt is effective to prevent ischemic complications of the spinal cord and kidneys during cross clamping of the descending thoracic aorta. Use of low dose of systemic heparin decreases postoperative blood loss and postoperative pulmonary hemorrhage caused by intraoperative lung manipulation (during systemic heparinization).

Key words: Descending thoracic aortic aneurysm, Aorto-aortic or aorto-femoral shunts.

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วัตถุประสงค์: เพื่อศึกษาถึงผลของการใช้ห้องคลังสต็อกในช่องทางของสำนักงานไปรษณีย์

การออกแบบ: การศึกษาบ่อยหลัง

หน่วยงาน: หน่วยศูนย์ศาสตร์ทางการศึกษาศาสตร์ คณะแพทยศาสตร์จุฬาลงกรณ์มหาวิทยาลัย

กลุ่มเป้าหมาย: ผู้มีอายุ 13 คน ได้รับการผ่านห้องคลังสต็อกในช่องทางของสำนักงานไปรษณีย์ ตั้งแต่ 2536 ถึง 2539 โดยใช้ห้องคลังสต็อก

ผลที่ได้: ติดตามผลการทดลองของการผ่านห้องคัดโดยเน้นที่ภูมิทัศนศิลปะของทางไปรษณีย์หลัก

ผลของการศึกษา: ในขณะที่อยู่ในระบบไปรษณีย์และมีการผ่านห้องก่อน 2 ขั้น มีการผ่านห้องคลังสต็อก

บทสรุป: การใช้ห้องคลังสต็อกสามารถป้องกันการขาดแคลนของไขขั้นหลังและโดยทั่วไปสามารถลดความปลอดภัยในช่องทางของสำนักงานไปรษณีย์ สามารถช่วยให้ช่องทางไปรษณีย์มีการผ่านห้องได้ในแน่นอน ที่เกิดจากการบุกคุ้มของปิดหน่อยแต่ละฝ่ายที่ขยายห้องคลังสต็อกที่ใช้ในการผ่านห้องคัดตรวจขนซึ่งเป็น สามารถใช้ได้ในผู้ป่วยกลุ่มนี้
Patients and methods

Between January 1993 and June 1996, 13 patients were operated on for descending thoracic aortic aneurysms. There were 11 male and 2 female patients. Ages ranged from 32 to 75 years with a mean of 67.8 years. Atherosclerosis was the etiology in 10 patients, Takayasu’s in one patient, post trauma in one patient an cystic medial necrosis in one patient.

Techniques of operation

Left posterolateral thoracotomy with some supination of the left groin to expose femoral vessels was the standard approach. A double lumen endotracheal tube was employed to facilitate one lung anesthesia. If the neck of the aneurysm was near the origin of the left subclavian artery, the chest was entered through the fourth intercostal space. If the aneurysm was long, the chest was entered via two intercostal spaces for proximal and distal control (step thoracotomy). Without disturbing adhesions with the lung, the aorta was dissected just proximal and distal to the aneurysmal part. A purse string was made in the ascending aorta, arch or proximal descending aorta. Another purse string was made in the descending aorta distal to the proposed distal cross clamping. One milligram per kilogram of body weight of heparin was given intravenously. A silastic cannula was inserted into the aorta at the purse string site. Both canulas were connected to a plastic tube which we generally used during ordinary open heart procedures. The aorta was then clamped and the aneurysm opened. Complete transection at both the proximal and distal ends was made. A proper size zero-porosity graft (Hemashield) was sutured to both cut ends with polypropylene suture. The distal clamp was released and careful deairing of the graft performed. Finally, the proximal clamp was released. Hemostasis was checked. The heparin was reversed with an equivalent dose of protamine sulfate. The cannulae were removed and the purse string sutures tied. The aneurysmal sac was sutured together to cover the graft. Chest tubes were inserted and the chest closed in the usual manner.

Results

Aorto aortic shunts were used in 12 patients and aorto left femoral arterial shunt used in one patient. There was one death caused by CVA secondary to intracerebral hemorrhage two weeks after surgery. In none of the patients was there excessively chest tube drainage in the postoperative period. Rethoracotomy to control bleeding was not necessary in any of the patients. There was no paraplegia or paraparesis among the survivors. There was no true acute renal failure requiring dialysis, but mild renal impairment with slight elevation of BUN and Cr levels was observed in three patients. They had good urine output and the abnormalities returned to normal during the postoperative period. There was no pulmonary hemorrhage among the patients.
Discussion

Definite and widely accepted methods of treatment for ascending and arch aortic aneurysm are well known. But for descending thoracic aneurysms, there are many different methods of repair. Crawford’s group in Houston favored simple cross clamping and repair and reported quite good results.\(^1,2\) The incidence of paraplegia was around 1-2%. Intravenous sodium nitroprusside was infused during aortic clamping to avoid excessively high proximal blood pressure and strain to the left ventricle. The most important factor determining the occurrence of paraplegia with this method is cross clamp time. Kart\(^3\) found that if the clamp time is less than 30 minutes there is no difference in the incidence of postoperative paraplegia whether there is distal perfusion or not. But if the clamp time is more than thirty minutes, distal perfusion definitely has a lower incidence of paraplegia after the operation. Most authors favored perfusion of the distal aorta during aortic clamping.\(^5,6\) However, the incidence of paraplegia in most series was around 7-9%. Crawford’s series showed remarkably good results, probably because Houston is the largest center for repair of aortic aneurysms.

Paraplegia after use of distal perfusion was explained by many factors, such as proximal hypotension during cross clamping due to bleeding, which reduced collateral blood flow to the segment of aorta distal to the cross clamping area. The origins of Adamchewics artery from the aorta between the two clamps will not gain any benefits from any methods used to bring blood to supply the distal part of the aorta.\(^7\) The homemade shunt technique has many advantages. Its simplicity is attractive. Low dose systemic heparin (1mg/kg) decreases postoperative bleeding. There was no incidence of clotting of the shunt or distal aorta in our patients.

Some centers used heparin coated (Gott’s) shunt from left ventricular apex, ascending aorta or aortic arch to distal thoracic aorta or femoral artery. No systemic heparin is required, so postoperative blood loss should be minimized. The shunt is more expensive compared to our homemade shunt. It is quite stiff and more difficult to handle. To get rid of air in the shunt itself is time consuming. These disadvantages outscore the benefit of avoiding systemic heparin. Again with low dose of systemic heparin, pulmonary hemorrhage is rare. Pulmonary hemorrhage is a common complication when full dose heparin (3mg/kg IV) is given and is precipitated by operative retraction of the lung.\(^8\) This did not happen in our series. Complications due to cannulation sites, such as bleeding, aortic dissection or thrombosis, did not occur in this group of patients. However, there are few potential disadvantages associated with using aortic shunt. These include uncertain distal blood flow and difficulties during cannulation or decannulation. Areas of the aorta that are heavily atherosclerotic should be avoided to prevent embolization, especially to cerebral circulation. If carefully used the aortic shunt should be safe and provide adequate blood
flow during repair of most descending thoracic aortic aneurysms. A left atrial left femoral arterial bypass is recommended in patients who have poor left ventricular function or other associated heart diseases. For very large aneurysms or recurrent patients when proximal cross clamping is expected to be difficult or impossible, and if the aneurysm involves the distal aortic arch, a femoro femoral bypass with profound systemic hypothermia and circulatory arrest is the best method.\(^{(9)}\)

**Conclusions**

Repair of descending thoracic aortic aneurysm by using aortic shunts with low dose systemic heparin was performed in 13 patients. There was paraplegia or acute renal failure in this series. This method is simple, economically attractive and safe for use in most descending thoracic aortic aneurysms.

**References**