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## 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.*

**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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กิตติชัย เหลืองทวีบุญ, เหมือนหมาย สรรประดิษฐ์, วิชัย เบญจชลมาศ, โยธิน คุโรวาท, ชวลิต อ่องจรีต. การใช้ท่อลัดโลหิต ในการผ่าตัดหลอดเลือดแดงใหญ่ในช่องทรวงอกส่วนปลายโป่งพอง. จุฬาลงกรณ์เวชสาร 2540 ก.พ;41(2): 127-32

- วัตถุประสงค์ :** เพื่อศึกษาถึงผลของการใช้ท่อลัดโลหิต ในการผ่าตัดหลอดเลือดแดงใหญ่ในช่องทรวงอกส่วนปลายโป่งพอง
- การออกแบบ :** การศึกษาย้อนหลัง
- หน่วยงาน :** หน่วยศัลยศาสตร์ทรวงอก ภาควิชาศัลยศาสตร์ คณะแพทยศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย
- กลุ่มเป้าหมาย :** ผู้ป่วย 13 คน ได้รับการผ่าตัดหลอดเลือดแดงใหญ่ในช่องทรวงอกส่วนปลายโป่งพอง ตั้งแต่ ปี พ.ศ. 2536 ถึง เดือนมิถุนายน 2539 โดยใช้ท่อลัดโลหิต ในช่องที่ร่างกายส่วนล่างขาดโลหิตไปเลี้ยง และให้เฮพารินขนาดต่ำทางหลอดเลือดดำ
- ผลที่ได้ :** ติดตามผลแทรกซ้อนของการผ่าตัดโดยเน้นที่อุบัติการณ์ของภาวะไตวายเฉียบพลัน อัมพาตของขา 2 ข้าง การเสียโลหิตหลังผ่าตัด
- ผลของการศึกษา :** ไม่พบภาวะไตวายเฉียบพลัน และอัมพาตของขา 2 ข้าง ผู้ป่วยเสียชีวิต 1 ราย เนื่องจากเลือดออกในสมองหลังการผ่าตัด การใช้ท่อลัดเลือดไม่ก่อให้เกิดการเสียเลือดหลังผ่าตัดมาก จนต้องผ่าตัดใหม่เพื่อห้ามเลือด
- บทสรุป :** การใช้ท่อลัดเลือดสามารถป้องกันการขาดเลือดของไขสันหลังและไตขณะทำการผ่าตัดหลอดเลือดแดงใหญ่ในช่วงทรวงอกส่วนปลายโป่งพอง การใช้เฮพารินขนาดต่ำลดการเสียเลือดหลังการผ่าตัดลดการมีเลือดออกในเนื้อปอดที่เกิดจากการบอบซ้ำของปอดในขณะที่ผ่าตัด ท่อลัดเลือดที่ทำจากท่อพลาสติกที่ใช้ในการทำผ่าตัดหัวใจชนิดเปิด มีราคาถูกและมีความปลอดภัยสูง สามารถใช้ได้ดีในผู้ป่วยกลุ่มนี้

## 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 and 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.<sup>(1,2)</sup> 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<sup>(3)</sup> 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.<sup>(5,6)</sup> 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.<sup>(7)</sup> 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 home made 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.<sup>(8)</sup> 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.<sup>(9)</sup>

### 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.

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