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ORIGINAL ARTICLE

Aorta-Iliac Bypass in Thoracoabdominal Aortic Aneurysm Repair in Young Chinese Patients

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Background Many surgical methods of thoracoabdominal aortic aneurysm repair (TAAAR) have been introduced over the past several decades, with varying degrees of success. We developed an aorta-iliac bypass technique to treat thoracoabdominal aortic aneurysm (TAAA) in young Chinese patients. The aim of this study is to evaluate the results of this technique intraoperatively and postoperatively.

Methods From June 2014 to March 2015, 28 patients underwent TAAAR using aorta-iliac bypass technique. A four-branched tetrafurcate graft was used. Two branches of the graft are sutured to bilateral common iliac arteries in an end-to-side fashion. The trunk of the graft was sutured to the proximal descending aorta in an end-to-end fashion. Then aorta-iliac bypass was established, and the lower extremities, viscera organ and spinal cord (SC) obtained perfusion from proximal descending aorta via the bypass graft. The thoracic and abdominal aorta were clamped in a staged fashion. The patent segmental arteries (SAs), and visceral arteries (coeliac trunk, superior mesenteric arteries, and renal arteries) were reattached sequentially. Evoked potential (EP) monitoring was adopted to assess the SC ischaemia throughout the procedure. The postoperative outcomes and follow-up results of this technique were evaluated.

Results There was no in-hospital mortality. Complications included acute kidney dysfunction and pulmonary haemorrhage in one case (3.6%) each. The SAs were reattached in all cases. The EP wave disappeared after proximal descending aorta was clamped, and gradually recovered after the patent SAs reattached. The median follow-up after operation was eight months (range, 1-10 months). There was no delayed neurologic deficit or late death.

Conclusions Thoracoabdominal aortic aneurysm repair using aorta-iliac bypass may be a simple and safe choice for young Chinese patients with thoracoabdominal aortic aneurysms.

Keywords Thoracoabdominal aortic aneurysm repair • Aorta-iliac bypass • Mortality • Spinal cord injury • Evoked potentials

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Introduction

Since DeBakey reported the first surgical procedure of thoracoabdominal aortic aneurysms (TAAA) in 1965 [1], several methods have been explored to improve clinical outcome including the clamp-and-sew technique and the use of distal perfusion. The manoeuver of distal perfusion includes passive bypass/shunt (without extracorporeal circulatory pump) and extracorporeal circulatory assistance. The later includes left heart bypass (LHB), partial cardiopulmonary bypass, and hypothermic circulation arrest. To prevent visceral, renal, and spinal cord (SC) ischaemic injury, organ protection can be supplemented with epidural cooling, cerebrospinal fluid drainage (CSFD), renal and visceral perfusion, and monitoring of motor evoked potentials (MEP) and somatosensory evoked potentials (SSEP) [2–10].

In China, most patients with thoracoabdominal aortic aneurysm are young, with relatively normal cardiac function, and serious kidney, liver, cerebral comorbidities are rare. Recently, we developed an aorta-iliac bypass technique for thoracoabdominal aortic aneurysm repair (TAAAR), which combines the operative efficiency and expediency of ‘‘cross-clamp and go" surgical approach with the concept of distal aortic perfusion. In this study, we evaluated the clinical outcomes of this technique. Evoked potential (EP) monitoring was adopted to assess the SC ischaemia throughout the procedure.

Materials and Methods

Patients' Data

The Ethics Committee of Beijing Anzhen Hospital, Capital Medical University approved this retrospective study (2014017). From June 2014 to January 2015, 28 patients with TAAA were treated with TAAAR using aorta-iliac bypass technique.

Anaesthesia

Anaesthesia was induced and maintained with propofol and remifentanyl. Muscle relaxation was induced and maintained with cisatracurium with a closed-loop infusion to maintain stable levels of neuromuscular blockade within a narrow range. Arterial blood pressures were consistently monitored at the right radial and dorsalis pedis arteries and the mean arterial blood pressure was maintained over 70 mmHg. A double-lumen endotracheal tube or bronchial blocker was inserted to allow selective deflation of the left lung. A pulmonary artery catheter was used, as well as transoesophageal echocardiograph. Cerebrospinal fluid pressure was kept at 10 mmHg during operation, and the drain remained in place for three days postoperatively.

Motor Evoked Potentials and Somatosensory Evoked Potentials Monitoring

A 16-channel Cadwell IOM system was performed during the procedure.

Motor evoked potential stimuli electrodes were placed on the scalp overlying motor cortices. Motor evoked potentials were recorded in the abductor pollicis brevis (hand), and the abductor hallucis muscles (foot). Motor evoked potential responses of hand muscles were used to recognise potential systemic or anaesthetic effect. Motor evoked potentials were measured every five minutes before aortic clamping and every minute during and after cross-clamping. Motor evoked potentials were recorded as present or absent. The absence of the wave was defined as a significant change, indicating SC ischaemia [11,12].

Somatosensory evoked potentials were elicited by stimulation of the posterior tibial nerves. Recording electrodes were placed at three levels: popliteal fossa, cervical spine (C5), and vertex. The median nerve was simultaneously stimulated, which was used to recognise the anaesthetic effect and technical issues. A baseline tracing was obtained before cross-clamping the proximal aorta. A 50% decrease in SSEP amplitude and/or a 110% increase in latency of baseline values were defined as significant change [11,12].

Surgical Technique

A standard posterolateral thoracoabdominal incision was made. Heparin was given systemically. A size-appropriate, four-branched tetrafurcate graft (Hemashield platinum, Maquet, Wayne, NJ) was used. The main procedure included six steps, as shown in Figure 1. Firstly, two branches of the

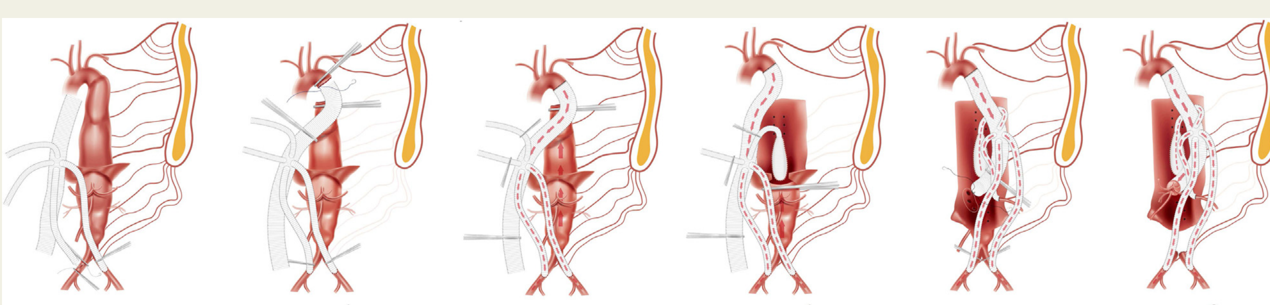

Figure 1 Spinal cord blood supply during TAAAR.