

Which Arterial Cannulation is Better for Acute Type a Aortic Dissection Repair?

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It is strongly believed that surgical results of management of acute type A dissection of the ascending aorta (AAD) are influenced by perfusion technique and cannulation site for cardiopulmonary bypass. From January 2010 to March 2016, 120 patients underwent emergency surgical repair of the AAD (mean age 52 ± 25 years, 78 male, 42 female). Medical records of 120 patients who received femoral (70), aortic arch (21), direct ascending aorta (18), carotid (10) or innominate artery (1) cannulation were reviewed. The hospital mortality rate was 12,5% (15 of 120); and not related to cannulation sites. The optimal site for aortic input for the repair of AAD should be chosen according to patient's status.

Key words: acute type A aortic dissection, arterial cannulation.

There is no agreement at present as to which is the optimal site for artery cannulation for cardiopulmonary bypass (CPB) in repair of acute type A aortic dissection (AAD). The femoral artery remains the most popular site for arterial input during operation [4]. Recently axillary artery cannulation is becoming a new standard technique aimed to avoid cerebral atheroembolization [5]. Some have employed either the carotid or axillary artery cannulation alone or in combination with femoral artery cannulation to overcome the drawbacks of single cannulation [6]. Several surgical groups prefer direct true lumen cannulation into dissected ascending aorta in surgery for this pathology. Thus, there are advantages and disadvantages in each cannulation technique.

Objective. We evaluated the safety and efficacy of different cannulation sites of the dissected ascending aorta in acute type A dissection.

Materials and methods. From January 2010 to March 2016, 120 patients underwent emergency surgical repair of the AAD (mean age 52 ± 25 years, 78 male, 42 female). All patients were operated on an emergent basis after the onset of aortic dissection within one week. All operations were performed either under deep hypothermic circulatory arrest (DHCA) alone or with the advent of antegrade selective cerebral perfusion. The average duration of circulatory arrest was 42 ± 17 min and that of myocardial ischemia was 127 ± 41 min.

The arterial cannulation site was decided individually, according to patient status and surgeon preference. Femoral artery was chosen as the site of arterial return in 70 patients, ascending aorta – in 18. A site in the aortic arch was chosen for cannulation in 21. We prefer to use this site if preoperative computed tomography angiography does not reveal additional intimal tears in an arch.

Open true lumen cannulation of the ascending aorta was performed in 5 patients with rupture of false lumen of dissected ascending aorta, cannulation of left carotid artery through a side graft – in 10, innominate artery – in one. Hemiarch aortic replacement was done in 23, supracoronary aortic replacement with aortic cusp resuspension – in 73, David operation – in 5 patients with Marfan syndrome, modified Bentall procedure – in 19 patients.

Results. The hospital mortality rate was 12,5% (15 of 120); during 2013–2016 years – 8.2% (5 of 61). The fatal cases were not related to cannulation sites but to bleeding (10.8%), low cardiac output (10%), renal insufficiency (5%) and mostly were associated with preoperative hemodynamic status. The permanent neurologic deficits occurred in 5 (4.1%) patients, temporary neurologic dysfunction – in 9 (7.5%) and were not associated with site of arterial input.

Discussion. Ascending aortic dissection (Stanford type A or DeBakey type I) is a surgical emergency associated with a high morbidity and mortality and is still a surgical challenge. Several techniques to establish a cardiopulmonary bypass for the emergency treatment of AAD have been reported, including femoral, subclavian, axillary, carotid artery, transapical or aortic cannulation [1, 3, 6]. It is strongly believed that surgical results of management of acute type A dissection of the ascending aorta are influenced by perfusion technique and cannulation site for CPB [2]. We have postulated that the site of cannulation depends not only on surgeons preference but on the inadequate organ or limb perfusion, on anatomical condition in particular patient – is false lumen of ascending aorta thrombosed or not, and on how really quick is need to institute the CPB.

Femoral cannulation is one of the most often used options for arterial return in AAD, was accomplished in 70 patients. However, due to complex anatomic interactions between the true lumen and the false lumen along the entire dissected aorta especially in DeBakey type 1, retrograde flow can possibly cause malperfusion and need conversion to another site. Although the real benefit of alternative to femoral cannulation technique, for example axillary or ascending aorta, remains controversial, we as others are inclined to cannulate true lumen of ascending aorta. Therefore, in 21 patients the cannulation of aortic arch in the site of lesser curve, which is usually uninvolved in dissection, was performed. However, in 3 cases the cannula was inserted in false lumen as it was recognized after aorta was opened.

The innominate artery cannulation was used for both CPB and selective antegrade cerebral perfusion in one patient, in whom the longer period of DHCA was expected according to preoperative CT scan. Compared to femoral artery cannulation, it is quicker to perform, avoids leg incision and ischemic complications of leg associated with cannulation and long bypass times. This technique provides antegrade flow at all stages of operation and thus avoids deep hypothermia.

For the same reason in order not to interrupt cerebral perfusion during performing «open distal anastomosis» in 10 patients we used unilateral perfusion through carotid artery. After cross-clamping of arch arteries during DHCA, unilateral carotid perfusion maintains cerebral perfusion by simple reducing the flow in the arterial line. Proposed by P.Urbanski both for acute dissecting and chronic aneurysm of aortic arch this site of cannulation and technique of perfusion provides adequate brain protection resulting in good neurologic outcome, as verified in recent clinical studies [7].

In 18 patients we used direct ascending aortic cannulation that has been advocated by the Hannover group for 20 years [1]. They described a trend toward a lower mortality rate in patients with aortic cannulation. This technique is easy and fast, ensuring antegrade flow in the aorta and could be especially useful in situations of hemodynamic instability.

Regardless of cannulation site, we inspect for malperfusion event initially after establishing CPB. We are monitoring the radial artery pressure on both arms, and in the case of essential difference between measurements the need to change the cannulation site should be considered. To cope with life-threatening malperfusion during CPB, arterial cannulation should be placed into the true lumen within a short time. Placing another cannula is one of the solutions.

Conclusion. The optimal cannulation site for the repair of AAD is still not known and should be chosen according to patient's status. In really emergencies, especially in ongoing

rupture of ascending aorta, direct true lumen cannulation is quick and safe method to start CPB. Due to relatively small study cohort no difference was demonstrated in favor of one method of cannulation over another. Every approach for arterial return for AAD was associated with a acceptable mortality rate.

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Який метод артеріальної канюляції кращий для операцій при гострому розшаруванні аорти типу А?

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Результати хірургічного лікування гострого розшарування висхідної аорти типу А вважають залежними від місця канюляції для проведення штучного кровообігу і методики перфузії. З січня 2010 по березень 2016 року виконано ургентні операції у 120 хворих (середній вік 52 ± 25 років, 78 чоловіків, 42 жінки). Проаналізовано дані 120 хворих, у яких здійснено канюляцію стегнової артерії (70), дуги аорти (21), пряму канюляцію висхідної аорти (18), сонної артерії (10) і брахіоцефального стовбура (1). Госпітальна летальність склала 12,5% (15 з 120) і не була пов'язана з місцем артеріальної канюляції. Оптимальне місце для артеріальної канюляції слід вибирати залежно від конкретного клінічного випадку.

Ключові слова: гостре розшарування аорти типу А, артеріальна канюляція.

Какой метод артериальной канюляции лучше для операций при остром расслоении аорты типа А?

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Результаты хирургического лечения острого расслоения восходящей аорты типа А считают зависящими от места канюляции для проведения искусственного крово-

обращения и методики перфузии. С января 2010 по март 2016 года выполнены urgentные операции у 120 больных (средний возраст 52 ± 25 лет, 78 мужчин, 42 женщины). Проанализированы данные всех 120 больных, у которых осуществляли канюляцию бедренной артерии (70), дуги аорты (21), прямую канюляцию восходящей аорты (18), сонной артерии (10) и брахиоцефального ствола (1). Госпитальная летальность составила 12,5% (15 из 120) и не была связана с методом артериальной канюляции. Оптимальное место для артериального возврата следует выбирать в зависимости от конкретного клинического случая.

Ключевые слова: острое расслоение аорты типа А, артериальная канюляция.