**Case
Report**

Repair of a Ductal Aneurysm Using a Hemi-Clamshell Incision in an Elderly Patient

Kazuhiro Kurisu, MD and Manabu Hisahara, MD

Spontaneous ductal aneurysm is rare in adults, although it is diagnosed sporadically, even in the elderly. Commonly, patients with a ductal aneurysm undergo an aneurysmectomy followed by patch-plasty through a lateral thoracotomy. However in older patients, more extensive surgery is often required due to more developed atherosclerotic lesions, requiring total arch replacement. Here, we describe the repair of a ductal aneurysm through a hemi-clamshell incision in an elderly patient. This method enabled excellent exposure of the entire aneurysm and, most importantly, adaptability in performing either an aneurysmectomy followed by patch closure, or total aortic arch replacement, dependent on the extent of the atherosclerotic disease once surgically exposed.

Keywords: ductal aneurysm, hemi-clamshell incision

Introduction

Spontaneous ductal aneurysm (SDA) is rare in adults, although it is sporadically diagnosed across all age groups, including the elderly.^{1–6)} Most patients undergo a left lateral thoracotomy, while a median sternotomy is recommended in only some cases requiring concomitant cardiac or aortic surgery.¹⁾ Although one of the characteristics of SDA is the absence of severe changes in atherosclerotic vessel morphology, more extensive surgery is necessary when the patient exhibits extensive atherosclerosis, as is commonly seen in elderly patients.^{2,3)} The current report describes the repair of a ductal aneurysm in an elderly patient via the hemi-clamshell approach.⁷⁾

Department of Cardiovascular Surgery, Kitakyushu Municipal Medical Center, Kitakyushu, Fukuoka, Japan

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Corresponding author: Kazuhiro Kurisu, MD. Department of Cardiovascular Surgery, Kyushu Kosei-Nenkin Hospital, 1-8-1 Kishinoura, Yahatanishi-ku, Kitakyushu, Fukuoka 806-8501, Japan

Email: kkurisu@qkn-hosp.jp

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Case Report

An 85-year-old man suffering from prolonged hoarseness for three years presented with an expanding aortic arch aneurysm following computed tomographic (CT) scanning. The patient had no history of chest injury, aortic dissection or aortitis syndrome. Chest radiography revealed an abnormal shadow adjacent to the aortic knob, with a cardiothoracic ratio of 42%. CT scanning revealed a saccular aneurysm containing a thrombus on the aortic arch protruding toward the pulmonary artery (**Fig. 1**). The patient was also diagnosed with recurrent nerve paralysis causing Ortner's syndrome.⁶⁾ This aneurysm was suspected to be a ductal aneurysm from its anatomical characteristics. Furthermore, the right subclavian artery independently and abnormally originated from the back of aortic arch (**Fig. 1**). Surgery was proposed, whereby the patient underwent aneurysmectomy followed by patch closure, although a total arch replacement would have been performed if the level of atherosclerosis surrounding the aneurysm were substantial.

Surgery was carried out through a hemi-clamshell incision (**Fig. 2**). This approach has been previously described in detail.⁷⁾ Briefly, the patient was positioned in a supine or mildly left anterolateral position. We then performed a left anterior thoracotomy through the 4th or 5th

Fig. 1 Preoperative CT scanning revealed a saccular aneurysm (asterisk) on the aortic arch, protruding toward the pulmonary artery. Note the aberrant right subclavian artery (arrows) originating from the aortic arch.

intercostal space followed by an upper-half median sternotomy. Two spring retractors were used to enhance exposure of the operative field.⁷⁾

Cardiopulmonary bypass was initiated with bilateral axillary arterial perfusion⁸⁾ and bicaval drainage. Adding direct cannulation to both carotid arteries enabled selective cerebral perfusion. Following the snaring of the carotid and left subclavian arteries, we clamped the ascending and descending aorta. Cardiac arrest was induced by infusion of cardioplegic solution. We maintained lower body circulation by perfusion through the femoral artery. Aortotomy was performed around the aneurysmal neck. Aortic clamps and snaring of arch vessels followed by balloon occlusion of the aberrant right subclavian artery established the bloodless field. The ductal aneurysm, including a minimal amount of the aortic wall surrounding the aneurysmal neck, was excised. The aortic wall was closed using an elliptical patch prosthesis, because the aortic wall was in relatively good condition without severe atherosclerosis or calcification.

The patient experienced an uneventful postoperative course of treatment. Histological examination revealed that the aneurysmal wall consisted of fibrous tissue lacking elastic fibers. One year after surgery, the patient was alive, and repair of the ductal aneurysm was intact.

Fig. 2 The patient's chest displaying a left hemi-clamshell incision (arrows).

Discussion

SDA in adults is rare¹⁻⁶⁾ and presents few symptoms except for hoarseness. If left untreated, it can lead to serious vascular complications including rupture, thromboembolism, erosion into adjacent structures, and infection, in order of frequency. Lund et al. reported that up to 47% of people with SDA experience some form of vascular complication when left untreated.²⁾ Because the condition can be debilitating and potentially fatal, surgical treatment is highly recommended once SDA is sufficiently diagnosed.^{2,3)}

As the aortic wall commonly does not express extensive atherosclerosis in SDA patients, aneurysmectomy followed by patch closure through a left lateral thoracotomy has been employed for most patients.¹⁻⁵⁾ The left lateral thoracotomy approach was initially proposed for the patient of the current case report, but was decided against because the potential for the patient to require a total arch replacement was relatively high, based on the patient's age.^{2,3)} Moreover, the aberrant right subclavian artery can complicate the procedure. Thus, surgery via a left hemi-clamshell incision was most appropriate in this particular case.

We have previously employed the left hemi-clamshell incision for total arch replacement in patients with distal arch aneurysms.⁷⁾ One advantage of this method of incision is the increased level of exposure of the aorta, from the aortic arch to the descending aorta. The approach also enables reliable distal anastomoses. Postoperative pulmonary

function is maintained because the phrenic and recurrent nerves are untouched. Furthermore, maintaining thoracic integrity by avoiding division of the lower sternum enhances physical rehabilitation.⁷⁾

Of note, ductal aneurysms are most commonly seen in infants and children. To our knowledge, the current case study reports the outcome of surgical therapy for SDA on the oldest patient to date. Unlike the formation and expansion of SDA in children, this elderly patient's aneurysm might have been related to atherosclerotic progression in the aortic wall.

We provide a case report of a patient in whom a spontaneous ductal aneurysm was repaired using the hemi-clamshell incision. This method provides an alternative and advantageous approach for repairing ductal aneurysms, enabling both excellent exposure and the technical ability to adapt surgical strategy as required.

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