Type B dissection involving a right-sided aortic arch

Abstract
Type B dissection involving a right-sided aortic arch is a very rare condition. Here we describe such an occurrence in an elderly patient who was initially managed medically but later underwent successful surgical repair after developing symptoms of expanding dissection. The dissection was approached through a right thoracotomy. Because of the unusual origin of the arch vessels and the direction of the dissected segment, aortic clamps could not be positioned satisfactorily, necessitating the use of full cardiopulmonary bypass and deep hypothermic circulatory arrest for the repair. The indications for surgery in Type B dissection and the modifications in the surgical strategy necessitated by the abnormal anatomy are discussed [Eur J Cardio-thorac Surg (1996) 10:477-479]

Key words
Dissecting aneurysm - Right aortic arch - Surgery

Introduction
Dissection of the aorta is a serious condition requiring early diagnosis and prompt treatment to improve the overall mortality and prevent late complications. The operative treatment of this condition was advanced by the report by DeBakey et al. in 1965 [2], while in the same year Wheat et al. demonstrated the usefulness of medical measures without surgery in treating this condition [12]. Surgery is used selectively in the treatment of type B dissection. Here we report an unusual case of a type B dissection involving a right-sided aortic arch which was surgically managed.

Case report
A 72-year-old man with no previous cardiovascular history presented with sudden onset chest pain. Computed tomography (CT) scan showed a type B dissection in the presence of a right-sided aortic arch (Figs. 1-3). He was found to be hypertensive and was treated with aggressive control of hypertension and after a few days was discharged home asymptomatic on anti-hypertensives. Three months later he presented again, this time with hoarseness of voice, shortness of breath, stridor and a bovine cough due to enlarging dissecting aneurysm. Repeat CT scan showed dissection compressing the trachea. An arch aortogram was performed to define the abnormal anatomy, since this had major implications for the impending surgical approach [10, 11]. This showed a right-sided aortic arch with mirror image branching of the great vessels (Figs. 4, 5) a pattern described in Maude Abbott’s classic study [5]. The first branch was a left innominate artery which gave rise to the left common carotid and subclavian arteries. The right common carotid and right subclavian arteries arose beyond the left innominate. The origin of the dissection was at the junction of the aortic arch and descending aorta and was well beyond the right subclavian origin. Distal to the aortic arch, the upper descending thoracic aorta swung to the left and then back across to the right side above the diaphragmatic hiatus. There was no evidence of extravasation of contrast from the false lumen during the examination. In view of these findings the decision was made to operate through a right thoracotomy. The pleura was clear and the dissected segment of the aorta appeared reasonably stable with no surrounding haematoma. The superior vena cava and right brachiophcephalic vein overlay the aorta. The segment of the dissected aorta which went to the left was inaccessible. Because of the unusual origin of the arch vessels and the direction of the dissected segment, aortic clamps could not be positioned satisfactorily, necessitating cardiopulmonary bypass and circulatory arrest. Aortic cannulation of the right-sided arch posterior to the superior vena cava and venous cannulation of the right atrium were easily accomplished through the right thoracotomy. Cardiopulmonary bypass was started and systemic cooling carried out progressively down to 15°C. At this point the aorta was opened with no clamps and a neck above and below the
Fig. 1 Contrast enhanced CT scan at the level of the aortic arch showing the dissection flap in the arch. The aortic arch is right-sided and passes behind the trachea where it contains a dissection flap [linear shadow]; the left innominate vein (straight arrow) lies in front of the left innominate artery (open curved arrow); the origin of the right common carotid artery is shown (solid curved arrow).

Fig. 2 Computed tomography scan at an intermediate level showing the dilated ascending aorta (A) and even more dilated descending aorta (D) which contains the dissection flap. The trachea is grossly compressed in a sagittal direction.

Fig. 3 Computed tomography scan at the level of the right pulmonary artery. The descending aorta (D) is moving to the right and no longer contains the dissection flap, though there is a cuff of presumed haematoma around it.

Fig. 4 Digital subtraction angiogram of the thoracic aorta and its major branches seen in LAO projection. The first branch is a left innominate artery seen immediately below the arch (arrow), giving rise to the left common carotid and the left subclavian arteries; the right common carotid and the subclavian arteries arise beyond the left innominate.

Fig. 5 Digital subtraction angiogram of the thoracic aorta and its major branches (LAO projection). This shows the dissection in the proximal descending aorta (star).
identified. The neck above was just distal to a right subclavian. A piece of 30 mm O-porosity Gelseal graft was selected and sutured with 3/0 Prolene. After 22 min flow was re-started with the graft cross-clamped. The aorta was then transected where it became of normal calibre and a second anastomosis was made with 3/0 Prolene. Rewarming was continued. The heart initially remained in ventricular fibrillation and after defibrillation, by placing the pads through the opened pericardium, stable sinus rhythm was restored. After a period of support, bypass was discontinued without difficulty with acceptable right atrial filling pressures. Postoperatively his recovery was uneventful.

Discussion

The term dissecting aneurysm was coined by Laennec in 1826 though current terminology correctly refers to this condition as aortic dissection [7]. Successful surgical and medical treatment were reported about 30 years ago [2, 12]. Dissection confined to the descending aorta (DeBakey type III, or type B) is usually managed conservatively in the first instance by controlled hypotension. The overall results from this strategy have been regarded as being as good as immediate surgery, although this policy is under review. If there is expansion of the dissected aorta with danger of rupture, as was the case in this patient, surgical repair is undertaken. DeBakey et al. advocate elective operation after initial medical treatment because the patients often develop complications [3]. Crawford et al. advise surgery in the chronic phase if the enlargement is twice the normal size or more than 6 cm [1]. In a review of 75 patients with type B dissection Kazuo Neya et al. found no absolute predictors of rupture though undoubtedly uncontrolled hypertension contributes to it [8]. Surgical strategy includes protection of the blood supply to the spinal cord during the period of aortic cross-clamping [4]. Our preference is to use of Gott shunt and a cell-saver and thus avoid the use of cardiopulmonary bypass; in this patient, because of the unusual origin of the arch vessels and the direction of the dissected segment, aortic clamps could not be positioned satisfactorily and hence the use of full cardiopulmonary bypass and deep hypothermic circulatory arrest was indicated. Other options include various forms of partial bypass, sometimes full bypass, and the option of using profound hypothermia and circulatory arrest [9]. Dissection in a right-sided arch must be a very rare occurrence, but has been reported before [6]. Right-sided arch as an isolated anomaly is rare and Type B dissection is an uncommon condition occurring in later life. The combination of a congenital arch anomaly and probably coincidentally acquired aortic dissection poses a challenge to the surgeon.

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References