Abdominal Coarctation and Alagille Syndrome

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ABSTRACT. Structural cardiac defects such as peripheral pulmonary stenosis are well-described in Alagille syndrome (AS), which is transmitted in an autosomal dominant inheritance. The genetic defect, with incomplete penetrance and variable expression, is localized to the short arm of chromosome 20. Abdominal coarctation is an uncommon congenital anomaly, with a spectrum of symptoms that may range from hypertension, intermittent claudication to abdominal pain. The association of abdominal coarctation with AS is rarely described. We report such a patient who also had aberrations of the visceral vascular supply involving the celiac, splenic, and superior mesenteric arteries. The indications to treat the coarctation, and in the context of a patient with AS, in whom liver transplantation may be contemplated at some stage, merit discussion.

CASE REPORT
An 8-year-old Indian girl was diagnosed with AS. She presented with cholestatic jaundice at 2 months of life, and liver biopsy showed paucity of intrahepatic bile ducts. She thrived well and was symptom-free except for pruritus. She had the characteristic triangular facies described. Cardiac examination revealed normal upper limb pulses but weak lower limb pulses. Her blood pressure was 111/54 mm Hg (right upper limb), 110/61 mm Hg (left upper limb), 90/60 mm Hg (right lower limb), and 100/65 mm Hg (left lower limb). Auscultatory findings included a grade 3/6 ejection systolic murmur at the infraclavicular region consistent with branch pulmonary artery stenosis that is commonly associated with this condition. Her erythrocyte sedimentation rate and C-reactive protein were not elevated.

Echocardiography demonstrated normal cardiac connections. Bilateral hypoplastic branch pulmonary arteries were noted. Doppler interrogation confirmed a gradient of 31 mm Hg and 24 mm Hg along the left and right pulmonary arteries, respectively. The aortic arch was right-sided, but no abnormality of the proximal descending aorta was noted on echocardiography. However, pulsation of the abdominal descending aorta was noted to be diminished.

Cardiac catheterization was performed to delineate angiographically the abdominal aorta based on the clinical suspicion of abdominal aortic coarctation and to document the right heart hemodynamics. The right ventricular systolic pressure was mildly elevated at 35/4 mm Hg and is a reflection of mild bilateral branch pulmonary artery stenosis. Most of the abnormal findings were demonstrated in the abdominal aortogram. The upper abdominal aorta was within normal limits, but its lumen narrowed significantly at the level below the origin of the renal arteries (Fig 1). Both renal arteries were catheterized, and hand injections indicated good flow in these. The celiac axis was also entered, which continued on to become the splenic artery. The superior mesenteric artery gave off the hepatic artery, the gastric artery, as well the right gastroepiploic artery (Fig 2). Although the superior mesenteric artery seemed to fill quite normally, stenosis at its origin is implied from the presence of a large collateral vessel in the mesentery (Fig 3). Immediately below the origin of the renal arteries, there was diffuse narrowing of the abdominal aorta.

DISCUSSION
AS is an autosomal dominantly transmitted genetic condition with a high mutation rate, incomplete penetrance, and variable expression.13 The genetic defect has been localized to the short arm of chromosome 20.14–17 This patient is the only 1 in our series of AS to have an associated abdominal coarctation. Literature search confirms that this is indeed a rare association, with only 1 described by Shefler et al18 as thoracic coarctation.19 In the patient of Shefler et al, there were symptoms of abdominal pain and intermittent
claudication. These necessitated surgery and the symptoms were relieved after surgical correction. Our patient differed in that the aortic narrowing began after the origin of the renal arteries and hypertension, which is usually a significant problem in these patients.

There was a difference between the volume of the upper limb pulses compared with the lower limbs clinically. The result of the pull-back pressure on catheter study was 30 mm Hg. The patient did not complain of intermittent claudication but it is uncertain if this would be a feature when she becomes increasingly more active in her physical activities in future.

The need for surgical intervention, in the middle aortic syndrome has to be carefully evaluated against the risks. Surgical morbidity may be substantial because of the frequently extensive nature of the vascular abnormality and the difficulty in making an appropriate graft. Percutaneous transluminal angioplasty has not resulted in long-term success. In general, the indications of surgery are reserved for those in whom medical control of blood pressure is unsatisfactory or where there are intolerable side effects arising from this condition.

At the moment, it was believed that surgery was not indicated in our patient because she was asymptomatic. Her renal arteries were of normal caliber and there was no upper limb hypertension. The fact that there was no evidence of left ventricular hypertrophy on the electrocardiogram and echocardiogram was a good indicator that there was no severe secondary effect on the heart. To repair the abdominal aorta would be a major undertaking at this stage, technical difficulty notwithstanding, because the narrowing involved a diffusely hypoplastic segment.

Detailed mapping of the visceral supply was important because the patient may have required liver transplantation for AS. It is imperative that the surgical team be aware of any abnormalities in the visceral arterial supply. The patient's abdominal aorta was significantly narrowed beyond the origin of the renal arteries. The pull-back pressure on catheter study was 30 mm Hg. The upper limb pulses were relatively smaller compared to the lower limbs. The patient did not complain of intermittent claudication, but it is uncertain if this would be a feature when she becomes more active in her physical activities in the future. The decision to perform surgery was carefully evaluated against the risks and complications. Surgical morbidity may be substantial due to the extensive nature of the vascular abnormality, making an appropriate graft challenging. Percutaneous transluminal angioplasty has not resulted in long-term success. The indications for surgery are reserved for cases where medical control of blood pressure is unsatisfactory or where there are intolerable side effects arising from this condition. In the current case, surgery was not indicated because the patient was asymptomatic. Her renal arteries were of normal caliber, and there was no upper limb hypertension. The absence of left ventricular hypertrophy on the electrocardiogram and echocardiogram was a good indicator that there was no severe secondary effect on the heart. Repairing the abdominal aorta would be a major undertaking at this stage, considering the technical difficulty and the diffusely hypoplastic segment. Detailed mapping of the visceral supply was important because the patient may require liver transplantation for abdominal coarctation. It is imperative that the surgical team be aware of any abnormalities in the visceral arterial supply.
vascular supply, especially to the liver, before the transplant. Although this aberrant vascular circulation would not in any way preclude a liver transplantation, it may potentially complicate the transplant and/or increase the risks.

The cause of the abdominal vascular aberration is uncertain. Differential diagnoses include Takayasu’s arteritis, neurofibromatosis, and mucopolysaccharidosis, which may result in narrowing of the abdominal aorta and vessels. In the former, the use of antiinflammatory agents may be useful in treatment. The inflammatory markers in our patient were negative and the clinical picture did not suggest Takayasu’s arteritis or the other differential diagnoses that may lead to narrowing of the abdominal aorta.

It remains to be seen if this abdominal vascular abnormality is a progressive disorder in our patient. The association between AS and peripheral pulmonary artery stenosis is certain and it is plausible that a defect in vascular growth, transmitted on a genetic basis, may be responsible. Yet, the aortic abnormality does not occur with nearly the same incidence as the pulmonary artery narrowing save for the possibility that milder cases are often missed. Bearing this in mind, it would be useful for physicians caring for patients with AS to look out for this anomaly.

CONCLUSION

This report highlights the presence of abdominal aortic narrowing and the associated abnormalities in the visceral vascular supply in a child with AS. There is a spectrum of symptoms in relation to the extent of the vascular abnormality. The indications to treat and the options available for the optimal treatment of the vascular problem are discussed. Apart from the fact that this may contribute to our better understanding of the pathogenesis of this condition, there are practical management issues to consider in a patient with AS. The bearing of these findings would be even more pronounced in the symptomatic child or where liver transplantation is being considered.

REFERENCES

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