CT diagnosis and prognosis in patients with aortic dissection or intramural haematoma type A involving pulmonary artery

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Aims and objectives

The aortic root and central pulmonary artery (main pulmonary artery, left/right pulmonary artery trunk) have an anatomical common adventitial[1-3], connective tissue sheath structure[2, 4], especially in the posterior wall of the aortic root[2]. In type A aortic dissection or intramural hematoma, the aortic wall ruptures to the adventitia. Increased intramural pressure causes extravasation, or breaks into the common adventitia and continues to the main pulmonary artery and the left and right pulmonary artery, resulting in pulmonary artery hematoma. When the hematoma is large, it may even cause stenosis of the pulmonary artery, and the rupture of the medial layer of the pulmonary artery can cause pulmonary artery dissection. Guilmette et al[5] retrospectively analyzed the pathological anatomy and histological manifestations of 3 AD and HPS patients by autopsy and pathology, confirming the above mechanism of HPS.

There are relatively few articles reported about aortic dissection or intramural hematoma involving pulmonary arteries. In 2009, Sueyoshi et al[6] retrospectively analyzed the CT findings of 232 patients with Stanford type A acute AD, and 21 patients of them were HPS, the detection rate was 9.1%. This is the largest group of literature so far. The 20 patients reported by Guilmette et al[5] in 2016 are the second largest group of literature. Currently there are few reports in this field and lack of literature on prognosis. We retrospectively diagnosed 264 such patients and analyzed the short-term prognosis during hospitalization. To investigate the diagnostic and clinical features of CT in type A aortic dissection or intramural hematoma involving pulmonary artery, in order to improve clinical diagnosis, treatment and prognosis.
Methods and materials

1. Study Population and Definitions

A total of 2133 consecutive cases of type A acute aortic dissection (AD) or intramural hematoma (IMH) were diagnosed by CT in Beijing Fuwai Hospital from January 2010 to December 2017. 264 cases of them were pulmonary artery involvement by CT retrospective diagnosis.

Acute aortic Syndrome(AAS) is defined as 14 days or fewer from symptom onset[7]. Classic AD was defined as the dissection with visible intimal tear and flow communication between true and false lumen. IMH was defined as a crescentic or circular high-attenuation area along the aortic wall without contrast enhancement in CT.[8]

Study approval was obtained from the Internal Review Board of Fuwai Hospital.

2. Research methods and scanning technique

A multi-slice spiral CT scanner was used, and a continuous volume-enhanced scan without cardiac gating was used for the aorta. All patients were in supine position, arms were lifted, and the scanning direction is from the head side to the foot side. The scanning range was generally from the thoracic inlet to common iliac Bifurcation level.

The automatic contrast agent tracking technology is used in the scan, and the region of interest is placed at the level of the descending aorta, and the threshold for triggering scan is set to 150 to 250HU (the threshold is different according to different models), then the scan is automatically or manually triggered.

A concentration of 300-370 mg l/ml contrast agent was injected through cubital fossa vein, the total amount was 50-80 mL, the injection flow rate was 4.0 mL/s, and 40 mL normal saline was added for washing.

3. Diagnosis of pulmonary artery involvement

When the pulmonary artery wall is involved, the hematoma spreads along the pulmonary artery wall, resulting in a moderate density thickening. The hematoma can spread along the central pulmonary artery to the hilar or segmental vessels. When the hematoma is large, the pulmonary artery wall is stiff, losing a streamlined shape, and even cause
pulmonary artery stenosis by compresses. In addition, there is a hematoma gap between the ascending aorta and the pulmonary artery. The visible image of intimal flap in pulmonary artery can be used to diagnose a pulmonary dissection. (Fig. A-D)

4. Treatment

Surgical treatment is preferred for patients with type A aortic dissection. Conservative treatment is used for type A intramural hematoma patients without obvious ulcer. Patients with critical hemodynamics situation or patients who refuse surgery should use conservative symptomatic treatment and antihypertensive treatment. The reported reasons for non-surgical treatment were advanced age, comorbidity, patient refusal, and death prior to planned surgery. In this study, 129 patients received conservative treatment and 135 patients underwent surgical treatment.
Fig. 1: Figs A-D, a 69-year-old male with aortic intramural hematoma involving pulmonary artery hematoma. AB, Initial CT scan, Acute aortic dissection II, involving the main pulmonary artery and right pulmonary artery (black arrow). Hematoma between the aorta and the right pulmonary artery caused the gap (white arrow) between the two major arteries, and the right pulmonary artery is compressed (black arrow); CD, Five month later CT scan, The hematoma gap disappeared between the two major arteries, and the right pulmonary artery hematoma disappeared and the compression was improved, but the localized dissection could be observed (white arrow).

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Fig. 3

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Fig. 4

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Results

Baseline Characteristics

Among 2133 patients with type A aortic dissection or intramural hematoma, 264 patients were retrospectively diagnosed with pulmonary artery involvement, and the detection rate was 12.38% (264 of 2133). The age of 264 patients ranged from 28 to 90 years (mean age 57.6±11.9), including 171 males and 93 females.

1. CT examination results

There were 191 cases of type A aortic dissection and 73 cases of type A intramural hematoma in 264 patients. As for the pulmonary artery involvement, 7 cases had dissection and 259 cases had hematoma. Pulmonary artery involvement by location was distributed as 99.24% (262 of 264) of main pulmonary artery involvement, 96.59% of right pulmonary artery (255 of 264), 30.68% of peripheral branch of right pulmonary artery (81 of 264), 85.61% of left pulmonary artery (226 of 264), and 18.18% of peripheral branch of left pulmonary artery (44 of 264).

2. Treatment and follow-up results

All patients had a mortality rate of 36.74% (97 of 264) during hospitalization. 135 cases were treated by surgery with a mortality rate of 12.59% (17 of 135), and 118 cases were discharged after operation (including 5 cases with paraplegia). 129 cases were treated by conservative treatment with a mortality rate of 62.01% (80 of 129).
Conclusion

Stanford type A acute AD is a emergent and severe event in clinic. The literature reported a pre-hospital mortality rate of 49% and a mortality rate of 47-57% within 30 days after admission[9, 10]. Although the optimal treatment remains controversial, Song et al[11] suggest timely surgery by cutoff values of 16 mm for IMH thickness and 55 mm for external diameter of ascending aorta. Multiple studies have shown that the aortic diameter is an independent predictor of dissection and intramural hematoma.

In this study, the in-hospital mortality rate of conservative treatment after admission was as high as 62.01%, and the mortality rate of emergency surgery was 12.59%. Defining the lesion as early as possible and timely surgical treatment may have important implications for its prognosis. We hypothesized that type A aortic dissection or intramural hematoma involving the pulmonary artery may also be a meaningful risk predictor of death.
References


