

Original Article

Typical and Atypical Aortic Dissection: Helical CT Diagnosis

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ABSTRACT

Acute aortic dissection is a challenging problem for cardiothoracic surgeons and radiologists. Early and accurate diagnosis is crucial to allow for dequate management.

Objectives: The aim of this study was to evaluate the role of helical computed tomography in the evaluation of aortic dissection with its typical and atypical patterns.

Methods: Between 1998 and September 2000, 86 patients underwent helical CT examination of the entire aorta for suspected dissection. Of the 86 patients, 32 were positive for aortic dissection (23 males and nine females, male-

female ratio of 2.6:1).

Results: Typical aortic dissection was diagnosed in 21 patients (65.7%) with 100% specificity and sensitivity. Of the 11 cases that were atypical (34.8%), three were intramural hematoma, one was a penetrating atherosclerotic ulcer and two cases were ruptured type B dissections. Atypical configuration of intimal flap was found in five cases.

Conclusion: Helical computed tomography with multiplanar reconstruction (MPR) provides early and accurate diagnosis of aortic dissection.

KEYWORDS: aortic dissection, CT, helical

INTRODUCTION

Acute aortic dissection is associated with high morbidity and mortality. It is considered a challenge not only for the cardiothoracic surgeons but also for the radiologists^[1]. An accurate and precise diagnosis is essential for immediate surgical intervention, thus diminishing the risk of severe hemorrhage and a fatal outcome.

Cross-sectional imaging has solved many diagnostic problems, especially with the development of helical modes. This has allowed for rapid examination with excellent overlapped sections that results in better multiplanar imaging. Helical CT can give accurate data about acute dissection of the aorta with high sensitivity and specificity^[2].

Aortic dissection occurs when there is a pulsating hematoma in the aortic wall, splitting the media and creating a false channel. The most common clinical presentation is acute severe back as well as interscapular pain. The exact etiology of aortic dissection is not clear. An intimal tear is thought to allow blood from the vessel lumen of the aorta into the media where it may extend proximally or distally but may also re-enter into the true vessel lumen^[3,4]. Another etiologic theory is that disease within the media leads to rupture of the vasa vasorum within the media layer itself causing an expanding hematoma, which subsequently breaks into the aortic lumen^[4,5].

Aortic dissection is classified as "type A" if the dissection involves the ascending aorta and "type B" if it is limited to the descending aorta. The complications of type A dissection include aortic valve disruption, cardiac tamponade and dissection of the origin of the coronary arteries and may also involve part of the aortic arch. Patients with complications of type A are generally treated surgically. Type B patients are usually managed via interventional procedures like endovascular stenting or prosthesis placement, unless a complication arises, such as aneurysm formation or persistent pain, that needs immediate surgical procedure^[4,6,7].

The CT features of aortic dissection are internal displacement of calcified intimal atheromatous plaque; a hyperdense thickened aortic wall (representing a thrombosed false lumen) on enhanced scans; demonstration of two contrast channels separated by an often spiral "intimal flap" on contrast enhancement; delayed opacification of the false channel on dynamic scanning or opacification of only the true lumen, which is often compressed by the thrombosed false lumen^[8,9].

The demonstration of the two lumina separated by an intimal flap is the classical diagnostic sign of aortic dissection. Internal displacement of calcified plaque and a hyperdense "false lumen" are signs of hematoma in the aortic wall. In recent articles, these have been described as atypical signs of aortic

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dissection^[10,11]. If the features of hematoma in the aortic wall are associated with the demonstration of an ulcerated lesion at CT, MRI, or angiography, then the criteria for the diagnosis of penetrating atheromatous ulcer has been met^[12-14].

The aim of this study was to evaluate the role of helical computed tomography in the diagnosis of typical and atypical forms of aortic dissection.

PATIENTS AND METHODS

All cases (86 patients) referred by their physicians to the Radiology Department, Farwanyia Hospital, Kuwait between 1998 and September 2000 with a clinical suspicion of acute aortic dissection were reviewed by four independent radiologists to determine the precise diagnosis of acute dissection and its pattern, if any. Note was taken of the site, extent and atypical presentation of each case. A total of 32 cases proved to have aortic dissection. Of them, 23 patients were males (69.7%) and nine were females (30.3%) resulting in a male to female ratio of 2.6:1. The age range was between 42-75 years with a mean age of 54 years.

All the patients presented clinically with various symptoms including severe interscapular pain, chest pain, abdominal pain, shock (pallor, sweating, hypotension, etc.) and dyspnea. The provisional clinical diagnosis was acute aortic dissection. A thorough history and relevant laboratory work-up was done for each case.

Helical CT examination of aorta including both its thoracic and abdominal portions was performed using the available a "Siemens AR CT unit" (Erlangen-Germany). The examination was done starting from the level of the aortic arch down to the level of its bifurcation into two common iliac arteries. Intravenous administration of non-ionic contrast (Ultravist 300 gm iodine/ml) from Schering AG-Germany. Automatic pump injector was utilized with a total dose of 120 ml and a rate of 2.5-3 ml/sec administered through an 18-gauge cannula, pre-inserted in the antecubital vein. A delay of 20 seconds was used, and then the helical scanning was started. The following parameters were used: slice thickness of 7 mm, pitch of 1.5, and 3.5-mm reconstruction interval. Reconstruction for the raw data was done at 2 mm thickness for better MPR quality images. The tube parameters used were KV 130 and 80 mAs.

RESULTS

The CT images were reviewed by four independent radiologists to assess the presence of aortic dissection, regarding its site, extent and pattern, whether typical or atypical.



Fig. 1: Typical aortic dissection of mid-thoracic aorta with intimal flap noted.



Fig. 2: Contrast enhanced CT scan at the level of the kidneys showing aneurysmal dilatation of the aorta with intimal flap and hypodense crescent of intramural hematoma. The enhancement of the left kidney is much higher as compared to the right one indicating implication of the right renal artery (not included in the photo) indirect sign.

The cases were subdivided into:

Typical aortic dissection, (Fig. 1) was encountered in 21 patients (65.6%). There were no cases of doubtful diagnosis as our technique had 100% specificity and sensitivity. All but two patients underwent surgical interventions (one refused further intervention, and the second patient died a few hours after diagnosis). The surgical data correlated well with our helical CT findings and the MPR reformatted images.

Atypical aortic dissection was encountered in 11 cases, three of them (54.6%) with intramural hematoma (Fig. 2), one (18.2%) with penetrating atherosclerotic ulcer (Fig. 3), two (36.4%) with ruptured "type B" dissection (Fig. 4), and atypical configuration of the intimal flap in four cases (72.8%). Of these four atypical configurations, one patient had a circumferential intimal flap (Fig. 5,6), two patients had filiform flaps (Fig. 7), one patient had a calcified false lumen (Fig. 8), and finally one patient showed a three channel dissection (Mercedes Benz configuration) (Fig. 9).



Fig. 3: A typical atherosclerotic ulcer of the arch of aorta. This is considered as a time bomb that needs immediate intervention.



Fig. 4: Helical CT of the chest (Mediastinal window setting) showing dense atherosclerotic calcification that is dehiscent posterolaterally with second lumen noted indirect sign of aortic dissection.

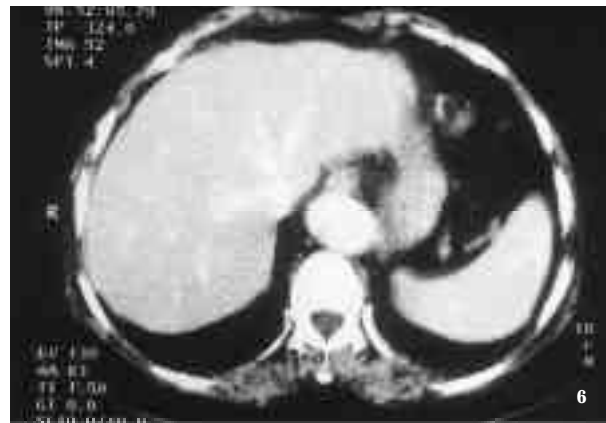


Fig. 5 & 6: Circumferential intimal flap is noted in a case of aortic dissection.



Fig. 7: Helical CT scan at the level of the proximal abdominal aorta showing atypical aortic dissection with tri-lumina caused by "V" shaped filiform intimal flap.

Multiplanar reconstruction (MRP) reformatted images were valid in assessing the extension of the aortic dissection added yet another informative image (Fig. 10 a, b).

DISCUSSION

Helical computed tomography is considered a major step forward in the field of diagnostic radiology. It is considered a relatively non-invasive tool for rapidly and accurately screening acute

dissection patients. CT can be used to direct patients to conventional angiography followed by interventional therapeutic techniques (endovascular repair), surgical intervention, or medical observation in ICU. The main merits of Helical technology are the speed of the examination, usage of minimal amount of contrast medium used. The technique is fast, accurate and easy to perform and has become an important radiological technique.

The patients with dissecting aortic aneurysm are in extreme critical condition, especially in type A dissection, as they may lead to cardiac tamponade, or involvement of the origin of the coronary arteries, and the rupture of the aorta with fatal outcome.

No other imaging modality can as comprehensively visualize an aortic dissection as rapidly as computed tomography. MRI does not have any advantages to the CT in diagnosis of aortic dissection and is a more time consuming technique, which may not be well tolerated by patients. The results from this study correspond to press reports on Helical CT and confirm this technique as the proffered diagnostic technique for rapid and accurate diagnosis of aortic dissection^[1,2,15,16].



Fig. 8: Venous-phase enhanced CT scan shows triradiate calcified intimal flap



Fig. 9: CT angiogram shows three-channel aorta (Mercedes-Benz sign).



Fig. 10 a & b: Multiplanar reconstruction image in sagittal orientation displaying the extent and the magnitude of the aortic aneurysm as well as the intimal flap.

CONCLUSIONS

Helical CT can be used in diagnosis of acute aortic dissection and also, for follow-up of chronic aortic dissection. Patients with acute aortic dissection may not demonstrate the typical pattern of dissection but may show atypical appearances of an intramural hematoma, penetrating atherosclerotic ulcer, rupture type B dissection or atypical configuration of intimal flap.

We recommend that any patient with suspected aortic dissection should undergo helical computed tomography with our presumed protocol to give the surgeons complete and accurate data about the extent, nature and the suspected complications of the dissecting aorta.

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