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### *Ruptured abdominal aortic aneurysm in computed tomography*

The prevalence of abdominal aortic aneurysm (AAA) in high-risk population, including individuals who are elderly, hypertensive and smokers has been estimated at about 20%. Rupture is a life-threatening complication of AAA. Mortality rates have been estimated to be 70–94% (1, 5, 8, 10), and up to 62% of patients with a ruptured AAA will die before reaching the emergency department (3). The early intervention increases fivefold the patients chances. The heavy complications (renal failure) occur in 75% of operated patients (3).

Because of the risk of rupture, AAAs are closely followed up for signs suggestive of AAA instability by using ultrasonography and CT. The size and the rate of expansion of the AAA are important in determining the stability and likelihood of the aneurysm rupture. The classic clinical triad of abdominal pain, hypotension and a palpable pulsatile aneurysm occurs in less than 50% of patients with aortic rupture (1, 7).

The aim of the study is presentation of the usefulness of CT examination in the evaluation of ruptured abdominal aortic aneurysms.

#### MATERIAL AND METHODS

The material comprised a group of six patients (two women and four men) aged 52–79 years, examined in the 2<sup>nd</sup> Department of Radiology, Medical University of Lublin between the year 1997 and 2002. In all patients US examination and CT was performed. USG was performed with Hitachi EUB 410 apparatus. CT was performed with Somatom AR. T scanner by Siemens, with two matrixes, 512 x 512 and 320 x 320 pixels. High resolution reconstruction algorithm was used with the possibility of performing spatial reformations. Five- and 10-mm axial sections were performed before and after administering of contrast agents. Delayed scans were performed to reveal extravasations of the contrast agent.

#### RESULTS

In three cases axial sections and MPR reconstructions revealed the presence of the periaortic haematoma with active extravasation of the contrasted blood (Fig. 1). The ruptured aneurysm in two cases was associated with extensive retroperitoneal haematoma (Fig. 2). The periaortic haematoma extended along the wall of the aneurysm. In one case the haematoma was localized mainly in front of aorta (Fig. 3). In one case of aneurysm of abdominal aorta and iliac arteries, the rupture of left iliac artery with large retroperitoneal haematoma in the pelvis and intensive extravasation of contrasted blood was seen (Fig. 4AB). The US examination with Power Doppler and Duplex facilitate in three cases the evaluation of aneurysm localization.



Fig. 1. Abdominal aortic aneurysm with extravasation of contrasted blood outside the aortic wall. Periaortic haematoma



Fig. 2. Large retroperitoneal haematoma with extravasation of contrasted blood



Fig. 3. Periaortic haematoma suggesting aneurysm rupture

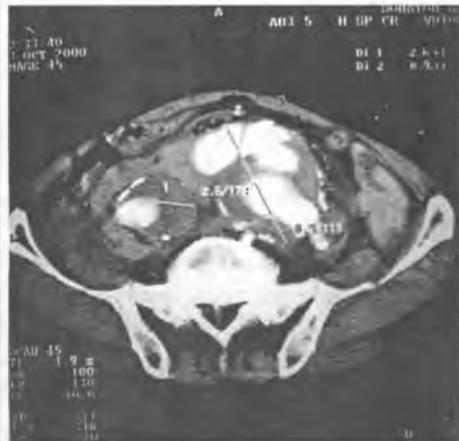
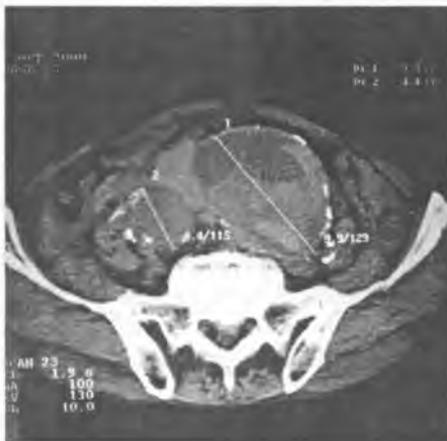


Fig. 4. Retroperitoneal haematoma with extravasation of contrasted blood. The ruptured aneurysm of the left common iliac artery (A – unenhanced section; B – axial section after administering of contrast agent)

## DISCUSSION

In the patients with suspected rupture of abdominal aortic aneurysm imaging examination should be performed, especially in patients with abdominal pain and unexplained hypotension. The CT examination is most often used in such patients. A large aneurysm is identified, and hyper attenuating periaortic blood may be seen extending into the perirenal space, pararenal space or both. Furthermore at the site of presumed rupture the aortic wall may be indistinct and extravasations of the contrast material may be seen at contrast enhanced CT images. However, CT findings of the contained or impending rupture may be subtle and difficult to diagnose. Therefore it is important to begin the CT examination of the suspected AAA rupture without contrast material enhancement, to prevent obscuration of the hyper attenuating crescent indicating and acute or impending AAA rupture. In the second phase of the examination the contrast material is administered intravenously to complete the CT examination (5).

The relation between the thrombus thicknesses, especially the rate of the thrombus growth with the possibility of aortic rupture, is underlined. The thrombus is present in about 90% of aneurysms (12).

The hyper attenuating crescent sign represents blood dissecting into the mural thrombus and/or aortic wall, and thus weakening the support structure of the aneurysm and increasing the likelihood of complete aortic rupture (5).

The risk of the rupture increase significantly in larger aneurysms. In symptomless aneurysms, 4–5 cm in diameter the risk of rupture is 1–21.5%; when the diameter is 7 cm the risk is 19–75% (1, 3). About 40% of ruptured aneurysms is over 5.5 cm in diameter (14). The risk of rupture justifies the operation of aneurysm larger than 5.5–6 cm (6).

The classical dramatic picture of a ruptured abdominal aneurysm resulting in severe abdominal and back pain accompanied by hemodynamic instability and shock is hard to miss. However, the patients presenting with an aneurysm leaking into the retro-peritoneal space resulting in a contained haematoma can pose diagnostic difficulties since complaints are often vague and patients may appear completely stable over a prolonged period of time. Retroperitoneal haematoma may progress to a rupture into the peritoneal cavity; such a delay may prove fatal. Therefore, the possibility of a ruptured abdominal aneurysm should be always considered when evaluating a patient with vague complaints and a retro-peritoneal mass in the presence of an aortic aneurysm (7, 8, 10).

Leaking abdominal aortic aneurysm is one of the most urgent conditions included into the acute abdomen. Because time is of the essence, patients suspected of having this life-threatening condition, patients if stable should be immediately taken to CT. The CT is often performed without administering of contrast agents, which is not necessary for the identification of retroperitoneal hemorrhage. The condition is diagnosed at CT by showing an abdominal aortic aneurysm with adjacent periaortic hemorrhage extending into the perirenal and pararenal spaces of the retroperitoneum (9).

In about 4% of ruptured aortic aneurysms spontaneous aortocaval fistula is found. Early diagnosis and surgical treatment are necessary for a successful outcome. Most abdominal aortic aneurysms rupture either into the retroperitoneum or into the peritoneal cavity. Rupture into the inferior vena cava or the duodenum are very rare (13).

Large retroperitoneal haematoma may be found in rupture of iliac artery aneurysm (15). The rupture of an abdominal aortic aneurysm is usually a catastrophic event. In rare cases, however the rupture remains concealed, becoming chronic conditions. Usually the chronic rupture is presented as a pulsatile abdominal mass. The CT examination usually reveals an infrarenal abdominal aortic aneurysm surrounded by haematoma and displaced by the mass of thrombus.

The time period over which this kind of lesion develops can be difficult to define, because the initial event usually produced minimal or no symptoms. Computed tomography using intravenous contrast is considered to be the best diagnostic tool for analyzing these lesions. It gives an adequate

anatomic view and also defines different densities, which enables identification of true lumen, thrombus and calcium deposits, and often the place of rupture, as extravasation of contrast agents (2, 16).

In cases of chronic rupture of abdominal aortic aneurysm the destruction of lumbar vertebra may be seen. The retroperitoneal haematoma, especially large, may dislocate kidneys (2, 10).

Retroperitoneal haematomas in chronic rupture of abdominal aortic aneurysm are usually localized in postero-lateral aspect forming organized thrombus confluent on CT images with psoas muscles. Recurrent bleeding may result in "onion skin" appearance (2).

Inflammatory haematomas are seen in 2–23%, with rupture in 10% of them (11). The thickness of aneurysm wall over 1 cm suggests the inflammatory aneurysm (4). The sensitivity of revealing such aneurysms is 41–60% (11).

## CONCLUSIONS

The rupture of abdominal aortic aneurysm is life-threatening condition, in vast majority of cases resulting in patient's death. In cases of acute rupture the clinical symptoms and CT examination of stable patients are essential. In chronic rupture the early diagnosis is very important. The main role plays CT examination, which enables revealing of the aneurysm, precise evaluation of the leakage, retroperitoneal haematoma, vertebral destruction and dislocation of aorta and kidneys.

## REFERENCES

1. Baird P. et al.: Sibling risks of abdominal aortic aneurysm. *Lancet*, 346, 601, 1995.
2. Booth M. I. et al.: Chronic contained rupture of an abdominal aortic aneurysm: a case report and review of the literature. *EJVES Extra*, 3, 33, 2002.
3. Castaneda-Zuniga W.: *Interventional Radiology*. Williams and Wilkins, 1, 1997.
4. Costello P. et al.: Spiral CT angiography of abdominal aortic aneurysm. *Radiographics*, 5, 397, 1995.
5. Gonsalves C. F.: The hyperattenuating crescent sign radiology, 211, 37, 1999.
6. Grainger R. et al.: Grainger and Allison's Diagnostic Radiology. A Textbook of Medical Imaging, Vol. 1, Churchill Livingstone 2001.
7. Hingh I. et al.: Ruptured abdominal aortic aneurysm presenting as a retro-peritoneal malignancy. *EJVES Extra*, 5, 76, 2003.
8. Lindholt J. et al.: Mass of high-risk screening for abdominal aortic aneurysm. *Br. J. Sur.*, 84, 40, 1997.
9. Neovelline R. et al.: Helical CT in emergency radiology. *Radiology*, 213, 321, 1999.
10. Nonami Y. et al.: Chronic contained rupture of an abdominal aortic aneurysm. *Cardiovascular Surgery*, 3, 227, 1995.
11. O'Gara P. et al.: Acute aortic dissection and its variants: Toward a common diagnostic and therapeutic approach. *Circulation*, 92, 1376, 1995.
12. Pretz R. et al.: Aortic dissection. *Lancet*, 349, 1461, 1997.
13. Rajmohan B.: Spontaneous aortocaval fistula. *J. Postgrad. Med.*, 48, 203, 2002.
14. Siegel C. et al.: CT of abdominal aortic aneurysms. *AJR*, 163, 17, 1994.
15. Ting A. C. W. et al.: Treatment of a ruptured iliac aneurysm with an endoluminal stent graft. *HKMJ*, 8, 145, 2002.
16. Villegas-Cabello O. et al.: Asymptomatic rupture of an aortoiliac aneurysm. *Tex. Heart Inst. J.*, 26, 219, 1999.

## SUMMARY

The aim of the study is presentation the usefulness of CT examination in evaluation of ruptured abdominal aortic aneurysms. Material comprises a group of six patients (two women and four men) aged 52–79 years, examined in the 2<sup>nd</sup> Department of Radiology, Medical University of Lublin between the year 1997 and 2002. In all patients US examination and CT was performed. USG was performed with a Hitachi EUB 410 apparatus. CT was performed with Somatom AR. T scanner by Siemens, with two matrixes, 512 x 512 and 320 x 320 pixels. High resolution reconstruction algorithm was used with the possibility of performing spatial reformations. Five- and 10 mm-axial sections were performed before and after administering of contrast agents. Delayed scans were performed to reveal extravasations of the contrast agent. In three cases axial sections and MPR reconstructions revealed the presence of the periaortic haematoma with active extravasation of the contrasted blood. The ruptured aneurysm in two cases was associated with extensive retroperitoneal haematoma. The periaortic haematoma extended along the wall of the aneurysm. In one case the haematoma was localized mainly in front of aorta. In one case of aneurysm of abdominal aorta and iliac arteries, the rupture of left iliac artery with large retroperitoneal haematoma in the pelvis and intensive extravasation of contrasted blood was seen. The US examination with Power Doppler and Duplex facilitate in three cases evaluation of aneurysm localization. The rupture of abdominal aortic aneurysm is life-threatening condition, in vast majority of cases resulting in patient's death. In cases of acute rupture the clinical symptoms and CT examination of stable patients are essential. In chronic rupture the early diagnosis is very important. The main role plays CT examination, which enables revealing of the aneurysm, precise evaluation of the leakage, retroperitoneal haematoma, vertebral destruction and dislocation of aorta and kidneys.

## Pęknięty tętniak aorty brzusznej w tomografii komputerowej

Celem badania jest przedstawienie użyteczności badania TK w ocenie pacjentów z pękniętym tętniakiem aorty brzusznej. Materiał stanowiła grupa 6 pacjentów (2 kobiety i 4 mężczyzn) w wieku 52–79 lat. U wszystkich pacjentów wykonano badanie USG oraz badanie TK przed i po podaniu środka kontrastowego. Badanie TK wykonano w przekrojach grubości 5 i 10 mm. Wykonano przekroje opóźnione w celu oceny wynaczynienia kontrastu. W trzech przypadkach przekroje osiowe i rekonstrukcje MPR wykryły obecność okołoaortalnego krwiaka z aktywnym wynaczynieniem krwi kontrastowej. Pęknięty tętniak w dwu przypadkach związany był z rozległym krwiakiem zaotrzewnowym. Okołoortalny krwiak rozciągał się wzdłuż ściany tętniaka. W jednym przypadku był zlokalizowany do przodu od aorty. W jednym przypadku tętniaka aorty brzusznej i tętnic biodrowych stwierdzono pęknięcie tętniaka lewej tętnicy biodrowej z dużym zaotrzewnowym krwiakiem w miednicy mniejszej oraz intensywnym wynaczynieniem kontrastowej krwi. Badanie USG z zastosowaniem Dopplera Mocy i badanie Duplex ułatwiło ocenę i lokalizację tętniaka w trzech przypadkach. Pęknięcie tętniaka aorty brzusznej jest stanem zagrażającym życiu, w większości przypadków kończącym się zgonem pacjenta. W przypadku ostrego pęknięcia tętniaka objawy kliniczne oraz badanie TK u pacjentów, u których jest możliwość jego wykonania, mają znaczenie podstawowe. W przypadkach przewlekłego pęknięcia tętniaka istotne znaczenie ma wczesne rozpoznanie. Główną rolę odgrywa tutaj badanie TK. Umożliwia ono rozpoznanie tętniaka, dokładną ocenę przecieku, krwiaka zaotrzewnowego, destrukcji żeber, przemieszczenia aorty i nerek.