

## CT Features of Chronic Contained Rupture of an Abdominal Aortic Aneurysm

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**Four cases among the 149 patients who required repair of an infrarenal abdominal aortic aneurysm (AAA) during the last five years, were chronic contained rupture. The first symptom at onset was back pain and physical examination revealed the patients to be in no acute distress. The sites of rupture were posterior in all cases. They were operated through an extraperitoneal approach. There was no operative mortality and all survived. The CT features, (1) discontinuity of the rim of calcification in the true aneurysm wall, (2) well defined soft tissue density adjacent to the aorta, (3) the concealed psoas muscle and the displaced viscera depending on the size of the lesion, and (4) no appearance of contrast material in the hematoma in some cases, led to the correct diagnosis of contained rupture. (Ann Thorac Cardiovasc Surg 2003; 9: 274–8)**

**Key words:** contained rupture, abdominal aortic aneurysm (AAA), extraperitoneal approach

### Introduction

There are many false-positive clinical diagnosis of abdominal aortic rupture, in one 1990's report, only 18 (28%) of 65 hemodynamically stable patients in whom aneurysm rupture was being considered actually had aortic ruptures at surgery.<sup>1)</sup> The utilization of computed tomography (CT) in the hemodynamic stable patient with abdominal aortic aneurysm (AAA) or lumbago can resolve the issue of chronic rupture in some cases.<sup>2)</sup> What kind of CT features can lead to the correct diagnosis?

### Cases

Among 149 AAA resections at Fukushima Medical University Hospital from June 1995 to July 2000, four cases (2.7%) were such a chronically ruptured AAA. The first symptom at onset was back pain and the physical exami-

nation revealed the patients to be in no acute distress. The sites of rupture were posterior in all cases. Treatment consisted of grafting with Dacron fabrics through an extraperitoneal approach. Table 1 summarizes the clinical data for four patients. Case 4 was transferred to hospital with severe pain and syncope seven months ago. However, he was treated as having temporary cerebral ischemia. Table 2 summarizes the CT features. The CT scan of case 2 revealed a 90×60 mm sized AAA with discontinuity of the rim of calcification in the true aneurysm wall (Fig. 1). Review of the CT scans revealed the same findings three months previously. Digital subtraction angiography (DSA) revealed a small focal bulge of contrast media from the aneurysm. In case 3, a 120×50 mm sized AAA was identified with discontinuity of the rim of calcification in the true aneurysm wall (40 mm in diameter) (Fig. 2). Diagnosis with CT prompted immediate corrective surgery in all patients. Table 3 summarizes the surgery and findings. In all cases, a tear was revealed on the posterior aspect. Through this tear, a huge pseudoaneurysm had developed. Inside the capsule, old laminated clots and a small amount of recently clotted blood were encountered. In case 3, when the aneurysm was opened, it revealed a 40 mm tear on its posterior aspect. Through this tear, the huge pseudoaneurysm had developed between the psoas muscle and vertebral bod-

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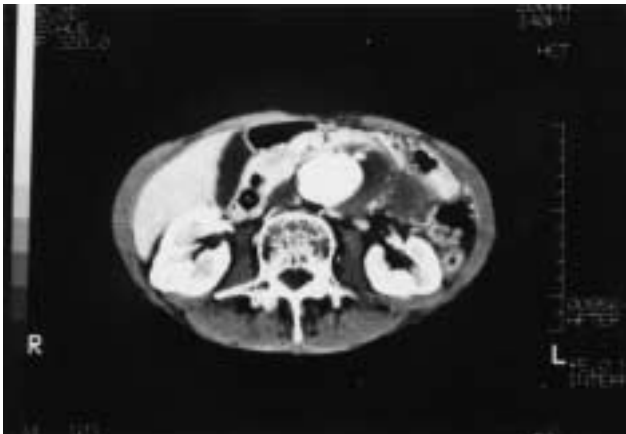
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**Table 1. Case histories of patients**

Patient no.	1	2	3	4
Age (year)/sex	66/F	66/M	84/M	75/M
Pain	Back	Back	Back	Back
Labo. WBC (/mm <sup>3</sup> )	9,200	8,200	9,400	4,600
RBC (×10 <sup>4</sup> /mm <sup>3</sup> )	281	362	361	398
Hct (%)	26.3	36.9	37.2	35.4
Hemodynamic stability	Yes	Yes	Yes	Yes
Blood pressure (mmHg)	150/90	110/70	156/86	130/68
Interval between rupture and operation (month)	1	3	6	7

**Table 2. CT features**

Patient no.	1	2	3	4
Extended aneurysm size include hematoma (mm)	97×87	90×60	120×50	70×50
Native aneurysm size (mm)	50	60	40	50
Discontinuity of the rim of calcification	+	+		
Delinerated hematoma	+	+	+	+
Well defined soft tissue density adjacent to the aorta	+	+	+	+



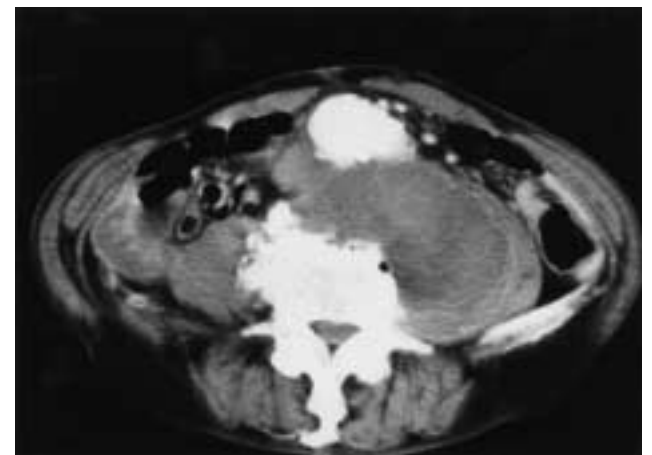
**Fig. 1.** Abdominal CT scan of case 2 showing a left posterior aneurysm rupture.



ies. In all these cases, Dacron fabric was grafted adequately and recovery was uneventful. Microscopic findings revealed arteriosclerotic aortic aneurysms and organized hematoma.

**Discussion**

The chronic rupture of an AAA is known as a “contained”<sup>2-4)</sup> or “sealed”<sup>5)</sup> rupture. Szilagy and associates first described this type of rupture in 1961.<sup>4)</sup> In their four cases the ruptures were small and hemorrhage was effectively encircled by the tissue surrounding the aortic wall.<sup>5)</sup> In rare cases, estimated at 3.3%<sup>4)</sup>-35%,<sup>2)</sup> the surrounding



**Fig. 2.** Abdominal CT scan of case 3 showing a left posterior aneurysm rupture between the psoas muscle and vertebral bodies.

**Table 3. Surgery and findings**

Patient no.	1	2	3	4
Site of rupture	Posterior wall	Posterior wall	Posterior wall	Posterior wall
Size of rupture	30×10	40×10	40×20	20×15
Psoas muscle	No relation	No relation	Between the muscle and vertebral body	No relation
Approach	Extraperitoneal	Extraperitoneal	Extraperitoneal	Extraperitoneal
Duration of operation (min)	275	244	383	231
Dacron graft	Bifurcated	Bifurcated	Bifurcated	Straight

tissue might effectively seal off the rupture of an AAA and the retroperitoneal hematoma is chronically contained. The sealed rupture might occur when the rupture is so small that the surrounding tissue effectively walls off the escape of blood. Because the blood loss is slow and protracted, the patient's hemodynamics remains stable.<sup>6)</sup>

Although some authors have reported aneurysms over 70 mm in diameter,<sup>2,7-9)</sup> this type of ruptured aneurysm is usually small<sup>10)</sup> or 60 mm or less in diameter on CT scan.<sup>3)</sup> In all patients in our cases, the original sizes of the aneurysm were less than 60 mm. In some instances, a small focal bulge or minimal aneurysm change in the wall of the aorta is found upon exploration.<sup>11,12)</sup> A rupture can be sealed off under the slow hemorrhage and high resistance of the surrounding structures.<sup>13,14)</sup> At this stage the aorta is probably still strong enough to contain the tear and minimize its size.<sup>6)</sup> In case 3, the psoas muscle contained the pseudoaneurysm. The site of rupture was posterior in our series, adjacent to the vertebral body. The vertebrae represent a strong structure able to tamponade the rupture.<sup>4)</sup>

Patients have often had symptoms for more than six months.<sup>10)</sup> According to autopsy findings, 10% of the patients with sealed ruptures of an AAA survived more than six weeks, but none lived longer than six months.<sup>15)</sup> Our longest survivor was seven months although some authors have described a symptomatic period up to two years.<sup>16)</sup> A sealed rupture is still at high risk for free rupture, as it may reopen the tear of the AAA wall by the gradual enlargement of the hematoma. Finally, bleeding with wide rupture and massive extravasation occurs. No one would argue that the best treatment for contained ruptured aneurysm is expeditious surgical repair.<sup>3)</sup>

When the original aortic lesion is small and barely palpable, it can be difficult to make the correct diagnosis. When complicated with a complex case history, the probability for misdiagnosis increases. Only the utilization of an abdominal CT scan with contrast media will resolve the correct diagnosis.<sup>2)</sup> CT is the most reliable, clear-cut

diagnostic tool, and is superior to ultrasonograms in displaying the aorta, especially if it has a surrounding mass.<sup>10,17)</sup> Among about 100 reported chronic contained ruptured AAA since 1961 in the English literature (Table 4), almost all were diagnosed by CT, however, very few mentioned the details of CT features. Contained rupture is more frequently characterized by a relatively well-defined soft tissue density adjunct to the aorta (cases 1-4), which may be associated with a localized defect in the concentric calcification of the aneurysm wall (cases 1, 2).<sup>3,9)</sup> The perirenal space, the posterior pararenal space, the psoas muscle, and extraperitoneal effusions furnished the anatomic basis for the CT findings.<sup>11)</sup> Hemorrhage into the perirenal space accounts for displacement of the renal hilar vessels, effacement of the aortic border, and silhouetting of the lateral psoas border at the level of the kidney. Hemorrhage into the posterior pararenal space accounts for loss of the lateral psoas margin inferior to the kidney and accounts for displacement of the left kidney. These two hemorrhages might be a "contained" rupture. The retroperitoneal mass will be displayed contiguous to the posterior aorta, typically silhouetting the psoas muscle and displacing the kidney.

The CT features, (1) discontinuity of the rim of calcification in the true aneurysm wall, (2) well defined soft tissue density adjacent to the aorta, (3) the concealed psoas muscle and the displaced viscera depending on the size of the lesion,<sup>11,17-20)</sup> and (4) no appearance of contrast material in the hematoma in some cases,<sup>9)</sup> lead to the correct diagnosis as a contained rupture.

The danger of an abdominal aortic aneurysm with contained rupture must be emphasized as the timing of the catastrophic rupture cannot be predicted.

## References

1. Kvilkeval KVH, Best IM, Mason RA, et al. The value of computed tomography in the management of symptomatic abdominal aortic aneurysms. *J Vasc Surg* 1990; **12**: 28-33.
2. Jones CS, Reilly MK, Dalsing MC, Glover JL. Chronic

**Table 4. Chronic contained ruptured AAA: reported series since 1961 in the English literature**

Year	Authors	Number of patients	CT diagnosis	Mortality	Remarks
1961	Szilagy <sup>4)</sup>	4	–	3/4	Misdiagnosis
1967	Razzuk <sup>21)</sup>	2	–	0/2	
1969	Stoney <sup>22)</sup>	4		0/4	
1981	Grabowski <sup>23)</sup>	3		1/3	
1982	Merchant <sup>24)</sup>	1		0/1	
	Lodder <sup>25)</sup>	2		0/2	
1986	Jones <sup>2)</sup>	7	+	0/7	Over 6 months
	Gavant <sup>15)</sup>	1	+		
1988	Haggins <sup>26)</sup>	1	+	0/1	
1990	Sterpetti <sup>3)</sup>	16	+	1/16	
	Nakagawa <sup>13)</sup>	1	+	0/1	
1993	Degener <sup>27)</sup>	1			
1994	Galessiere <sup>28)</sup>	3	+	0/3	
	Garb <sup>29)</sup>	1	+		
1995	Gilling-Smith <sup>30)</sup>	9*		3/9	*Unclear diagnosis
	Aune <sup>31)</sup>	1	+	0/1	
	Ikeda <sup>32)</sup>	1	+	0/1	
1996	Nonami <sup>33)</sup>	2	+	0/2	
	Gupta <sup>34)</sup>	2	+	0/2	Mycotic
	Ohtake <sup>35)</sup>	1	+	0/1	
1997	Ghalili <sup>36)</sup>	1	+	0/2	
	Louagie <sup>7)</sup>	1	+		Large psoas abscess
	Cappeller <sup>8)</sup>	13	+		
1998	Ihara <sup>37)</sup>	1	+	0/1	
	Louagie <sup>38)</sup>	1	+		
1999	White <sup>10)</sup>	1	+	0/1	
	Sultan <sup>11)</sup>	1	+		
	Villegas-Cabello <sup>39)</sup>	1	+	0/1	
2000	Kapadia <sup>40)</sup>	2	+		
	Seelig <sup>41)</sup>	1		0/1	
2001	Muller <sup>42)</sup>	20	+	7/20	TAA including
	Chuter <sup>43)</sup>	1	+	0/1	
	Dorrucci <sup>9)</sup>	1	+	0/1	
	Kapoor <sup>44)</sup>	1	+	0/1	After grafting
	Defraigne <sup>12)</sup>	5	+	0/5	
2002	Tuma <sup>17)</sup>	1	+	0/1	After endograft

- contained rupture of abdominal aortic aneurysm. *Arch Surg* 1986; **121**: 542–6.
- Sterpetti AV, Blair EA, Schultz RD, et al. Sealed rupture of abdominal aortic aneurysms. *J Vasc Surg* 1990; **11**: 430–5.
  - Szilagy DE, Smith RF, Macksood AJ, Whitcomb JG. Expanding and ruptured abdominal aortic aneurysms. Problems of diagnosis and treatment. *Arch Surg* 1961; **83**: 395–408.
  - Flinn WR, Courtney DF, Yao JST, Bergan JJ. Contained rupture of aortic aneurysm. In: Bergan JJ, Yao JST eds.: *Aortic Surgery*. Philadelphia: WB Saunders, 1989; pp 341–50.
  - Szilagy DE. Clinical diagnosis of intact and ruptured abdominal aortic aneurysms. In: Bergan JJ, Yao JST eds.: *Aneurysms: Diagnosis and Treatment*. New York: Grune & Stratton, Inc., 1982; pp 205–16.

- Louagie YA, de Canniere L, Donckier J, et al. Infected abdominal aortic aneurysm associated with a psoas abscess, aorto-duodenal and sigmoid fistulas. Case report and review of the literature. *Acta Chir Bel* 1997; **97**: 39–43.
- Cappeller WA, Engelmann H, Blechschmidt S, et al. Possible objectification of a critical maximum diameter for elective surgery in abdominal aortic aneurysms based on one- and three-dimensional ratios. *J Cardiovasc Surg (Torino)* 1997; **38**: 623–8.
- Dorrucci V, Dusi R, Rombola G, Cordiano C. Contained rupture of an abdominal aortic aneurysm presenting as obstructive jaundice: report of a case. *Surg Today* 2001; **31**: 331–2.
- White GH, May J, Petrusek P, et al. Endotension: an explanation for continued AAA growth after successful endoluminal repair. *J Endovasc Surg* 1999; **6**: 308–

- 15.
11. Sultan S, Madhavan P, Colgan MP, et al. Aorto-left renal vein fistula: is there a place for endovascular management? *J Endovasc Surg* 1999; **6**: 375–7.
12. Defraigne JO, Sakalihan N, Lavigne JP, et al. Chronic rupture of abdominal aortic aneurysm manifesting as crural neuropathy. *Ann Vasc Surg* 2001; **15**: 405–11.
13. Nakagawa Y, Masuda M, Shiihara H, et al. A chronic contained rupture of an abdominal aortic aneurysm complicated with severe back pain. *Ann Vasc Surg* 1990; **4**: 189–92.
14. Clayton MJ, Walsh JW, Brewer WH. Contained rupture of abdominal aortic aneurysms: sonographic and CT diagnosis. *AJR Am J Roentgenol* 1982; **138**: 154–6.
15. Gavant ML, Salazar JE, Ellis J. Case report. Intrarenal rupture of the abdominal aorta: CT features. *J Comput Assist Tomogr* 1986; **4**: 529–32.
16. Darling RC. Ruptured arteriosclerotic abdominal aortic aneurysms. A pathologic and clinical study. *Am J Surg* 1970; **119**: 402–7.
17. Tuma MA, Hans SS. Rupture of abdominal aortic aneurysm with tear of inferior vena cava in a patient with prior endograft. *J Vasc Surg* 2002; **35**: 798–800.
18. Johnson WC, Gale ME, Gerzol SG. The role of computed tomography in symptomatic aortic aneurysms. *Surg Gynecol Obstet* 1986; **162**: 49–53.
19. Senapatti A, Hurst PAE, Thomas IL. Differentiation of ruptured aortic aneurysm from acute expansion by computerized tomography. *J Cardiovasc Surg (Torino)* 1986; **27**: 719–22.
20. William LR, Flinn WR, Yao JST. Extended use of computed tomography in the management of complex aortic problem: a learning experience. *J Vasc Surg* 1985; **4**: 264–71.
21. Razzuk MA, Linton RR, Darling RC. Femoral neuropathy secondary to ruptured abdominal aortic aneurysms with false aneurysms. *JAMA* 1967; **201**: 139–42.
22. Stoney RJ, Wylie EJ. Surgical treatment of ruptured abdominal aneurysms: factors influencing outcome. *Calif Med* 1969; **111**: 1–4.
23. Grabowski EW, Pilcher DB. Ruptured abdominal aortic aneurysm manifesting as symptomatic inguinal hernia. *Am Surg* 1981; **47**: 311–2.
24. Merchant RF, Cafferata HT, DePalama RG. Ruptured aortic aneurysm seen initially as acute femoral neuropathy. *Arch Surg* 1982; **117**: 811–3.
25. Lodder J, Cheriex E, Oostenbrook R, et al. Ruptured abdominal aortic aneurysms presenting as radicular compression syndrome. *J Neurol* 1982; **227**: 121–4.
26. Higgins R, Peitzman AB, Reidy M, Stapczynski S, Steed DL, Webster MW. Chronic contained rupture of abdominal aortic aneurysm presenting as a low extremity neuropathy. *Ann Emerg Med* 1988; **17**: 284–7.
27. Degener JE, Voesten HG, Nap M, et al. Rupture of an aortic aneurysm caused by Haemophilus influenzae type B infection. *Vasa* 1993; **22**: 247–50.
28. Galessiere PF, Downs AR, Greenberg HM. Chronic, contained rupture of aortic aneurysms associated with vertebral erosion. *Can J Surg* 1994; **37**: 23–8.
29. Garb M. Appendicitis: an unusual cause of infected abdominal aortic aneurysm. *Australas Radiol* 1994; **38**: 68–9.
30. Gilling-Smith GL, Worswick L, Knight PF, et al. Surgical repair of thoracoabdominal aortic aneurysm: 10 year's experience. *Br J Surg* 1995; **82**: 624–9.
31. Aune S, Trippstad A. Chronic contained rupture of an abdominal aortic aneurysm complicated by infection and femoral neuropathy. *Eur J Surg* 1995; **161**: 613–4.
32. Ikeda M, Kambayashi J, Kawasaki T. Contained rupture of infected abdominal aortic aneurysm due to systemic candidiasis. *Cardiovasc Surg* 1995; **3**: 711–4.
33. Nonami Y, Ogoshi S. Chronic contained rupture of abdominal aortic aneurysms. *J Cardiovasc Surg (Torino)* 1996; **37**: 25–8.
34. Gupta AK, Bandyk DF, Johnson BL. In situ repair of mycotic abdominal aortic aneurysms with rifampin-bounded gelatin-impregnated Dacron grafts: a preliminary case report. *J Vasc Surg* 1996; **24**: 472–6.
35. Ohtake H, Mukai K, Watanabe Y. Twice sealed-rupture of a small abdominal aortic aneurysm with unusual computed tomography findings. A case report. *J Cardiovasc Surg (Torino)* 1996; **37**: 249–50.
36. Ghalili KC, Khan JH. Treatment of aortic dissection and ruptured abdominal aneurysm with coronary bypass. *Ann Thorac Surg* 1997; **63**: 223–5.
37. Ihara A, Chiba Y, Kimura T, et al. Abdominal aortic aneurysmectomy in the octogenarian. *Ann Thorac Cardiovasc Surg* 1998; **4**: 247–50.
38. Louagie Y, Valizadeh A, Brockman C, et al. Recurrent supra-anastomotic aneurysm following infrarenal aortic repair. *Acta Chir Bel* 1998; **98**: 250–4.
39. Villegas-Cabello O, Siller J. Asymptomatic rupture of an aortoiliac aneurysm. *Tex Heart Inst J* 1999; **226**: 219–22.
40. Kapadia BJ, Agarwal M, de Silva RD. Primary aortoduodenal fistulas in minimally aneurismal aortas: imaging diagnosis. *Abdom Imaging* 2000; **25**: 51–4.
41. Seelig MH, Berchtold C, Jakob P, Schonleben K. Contained rupture of an infrarenal abdominal aortic aneurysm treated by endoluminal repair. *Eur J Vasc Endovasc Surg* 2000; **19**: 202–4.
42. Muller BT, Wegener OR, Grabitz K, et al. Mycotic aneurysms of the thoracic and abdominal aorta and iliac arteries: experience with anatomic and extra-anatomic repair in 33 cases. *J Vasc Surg* 2001; **33**: 106–13.
43. Chuter TA, Gordon RL, Reilly LM, et al. An endovascular system for thoracoabdominal aortic repair. *J Endovasc Surg* 2001; **8**: 25–33.
44. Kapoor V, Kanal E, Fukui MB. Vertebral mass resulting from a chronic-contained rupture of an abdominal aortic aneurysm repair graft. *AJNR Am J Neuroradiol* 2001; **22**: 1775–7.