Paraplegia after iatrogenic extrinsic spinal cord compression after descending thoracic aorta repair: Case report and literature review

Paolo Biglioli, MD, Maurizio Roberto, MD, Aldo Cannata, MD, Alessandro Parolari, MD, and Rita Spirito, MD, Milan, Italy

Paraplegia is a devastating complication of descending thoracic aorta repair, with a reported incidence as great as 38%.¹ We describe an unusual case of postoperative paraplegia after iatrogenic extrinsic spinal compression.

Clinical Summary

In December 1999, a 38-year-old man was referred after a computed tomographic scan diagnosis of a syphilitic aneurysm located in the middle third of the descending thoracic aorta and eroding extensively the vertebral bodies at the T7 to T8 level. Because of the sudden appearance of interscapular pain, the patient was admitted to our department in January 2000. An aortogram confirmed the initial diagnosis. A descending thoracic aortic aneurysm repair was planned. A catheter was placed at the L2 level for perioperative cerebrospinal fluid drainage. Thoracic epidural anesthetic and analgesic techniques were not used. The surgical access was a double left posterolateral thoracotomy in the fourth and sixth intercostal spaces. At thoracotomy, brisk bleeding from a branch of the sixth posterior intercostal artery was controlled with difficulty by electrocautery. Packed oxidized cellulose gauzes (Surgicel; Ethicon, Inc, Somerville, NJ) were placed at the level of the costovertebral angle to prevent recurrence of bleeding. Severe dystrophy and osteomalacia of thoracic vertebrae eroded by the aneurysm were observed. Aortic replacement with a prosthetic graft was performed with a previously described quick simple clamping technique.² Aortic crossclamping time was 11 minutes. No other intraoperative complications occurred.

On awakening from anesthesia, the patient had bilateral leg numbness, which spread progressively up to the umbilicus. Ten hours later, a flaccid paraplegia occurred progressively. Such neurologic injury was judged irreversible and the result of compromise of spinal blood flow during aortic crossclamping. Magnetic resonance imaging (MRI) was performed only 90 hours from onset of the symptoms to enable precise location of the site and assess-

ment of the extent of damage. MRI showed a mass compressing the spinal cord at T6 (Figure 1). An emergency posterior left laminectomy was performed, and a gelatinous mass located in the epidural space and compressing the spinal cord was removed. Microscopic examination confirmed that the mass was formed of oxidized cellulose gauze and hematoma. Unfortunately, the paraplegia did not improve after surgical decompression, although there was a partial sensory recovery.

Discussion

To our knowledge this is the first report of postoperative paraplegia caused by hematoma and accidental introduction of a widely accepted topical hemostatic agent,³ oxidized cellulose gauze, into the thoracic spinal epidural space during aortic repair. Fifteen previous reports⁴⁻¹¹ have described this unusual but catastrophic complication after pulmonary surgery (Table 1). Our case and these previous cases share a surgical access route, posterolateral thoracotomy, and similarly feature difficulty in maintaining hemostasis at the posterior edge of chest incision, proximate to the costovertebral junction. Svensson,¹² in a recent review of aortic surgery, warned about the theoretical risk of spinal compression and paraplegia after placement of hemostatic gauze. However, paraplegia after thoracic aortic repair is a relatively frequent complication^{1,9} that is generally considered to be the result of compromise of medullary blood flow during aortic crossclamping or after ligation of posterior intercostal arteries.¹ Because of this bias, the real incidence of iatrogenic extrinsic compression is probably underestimated. In fact, postoperative diagnostic imaging studies with computed tomography and MRI are rarely performed after aortic repair complicated by paraplegia, and autopsy reports are anecdotal. Mawad and colleagues¹³ published MRI findings from 24 patients who had spinal injury after thoracoabdominal aortic replacement, and extrinsic compression was not detected in any case. On the other hand, paraplegia after thoracotomy for nonaortic surgery is an extremely uncommon complication, with an estimated incidence of 0.08%,⁹ and therefore prompts urgent etiologic diagnosis with imaging investigations. In addition, with both pathogenetic mechanisms, extrinsic compression and blood flow reduction, the damage is localized in the thoracic spinal cord, and the resulting clinical pictures are similar. Medullary ischemia seems more frequently associated with a low-thoracic spinal injury,¹³ whereas extrinsic compression is more frequently associated with a midthoracic injury⁴⁻¹¹ (at the thoracotomy level). Moreover, as with paraplegia resulting from medullary ischemia,¹⁴ paraplegia from extrinsic spinal compression may arise early (within 24 hours after the patient awakens from the anesthesia)^{4,6,7,10,11} or later^{5,7,8} in the postoperative course. A prompt diagnosis is critical to

From the Department of Cardiovascular Surgery, Centro Cardiologico Fondazione Monzino, University of Milan, Milan, Italy.

Received for publication Nov 6, 2001; accepted for publication Dec 5, 2001.

Address for reprints: Maurizio Roberto, MD, Department of Cardiovascular Surgery, Centro Cardiologico Fondazione Monzino, Via Parea, 4, 20138, Milan, Italy (E-mail: maurizio.roberto@cardiologicomonzino.it).

J Thorac Cardiovasc Surg 2002;124:407-10

Copyright © 2002 by The American Association for Thoracic Surgery

0022-5223/2002 \$35.00+0 12/54/122138

doi:10.1067/mtc.2002.122138

Figure 1. Left, T1-weighted sagittal view of MRI scan showing mass (black, olive like) located at T6 and compressing spinal cord. Extensive anterior erosion of T7 and T8 vertebral bodies is evident. Right, T2-weighted axial view of MRI scan shows mass with thick white border located at left side of T6 in epidural space and compressing spinal cord.

TABLE 1. Summary of reported cases of iatrogenic postthoracotomy paraplegia

Reference	Year	Patient age (y)	Patient sex	Surgical procedure
Perez-Guerra and Holland ⁴	1984	59	F	Left pneumonectomy
Tashiro et al ⁵	1987	56	M	Right upper pulmonary lobectomy
Batellier et al ⁶	1989	58	M	Right upper pulmonary lobectomy
Short ⁷	1990	72	F	Right upper and middle pulmonary lobectomy
Short ⁷	1990	49	M	Right upper pulmonary lobectomy
Short ⁷	1990	59	M	Right lower pulmonary lobectomy
Wada et al ⁸	1993	69	M	Right upper pulmonary lobectomy
Wada et al ⁸	1993	37	NR	Right upper pulmonary lobectomy
Attar et al ⁹	1995	53	M	Left upper pulmonary lobectomy
Attar et al ⁹	1995	73	M	Left lower pulmonary lobectomy
Attar et al ⁹	1995	40	M	Left upper pulmonary lobectomy
Attar et al ⁹	1995	63	M	Pulmonary decortication
Attar et al ⁹	1995	20	M	Repair of stab wound
Iwabuchi et al ¹⁰	1997	46	F	Right lower pulmonary lobectomy
Lovstad et al ¹¹	1999	56	F	Left lower pulmonary lobectomy

In all cases intraoperative diagnosis was made during urgent laminectomy. *Early*, Within 48 hours from thoracic operation; *delayed*, after 48 hours or more from thoracic operation; *F*, female; *M*, male; *NR*, not reported.

facilitate spinal recovery by emergency laminectomy. If decompression is performed within 8 hours after symptoms are seen, the incidence of paraplegia is about 20%, whereas after 24 hours the risk of paraplegia rises to 60%.¹⁵ Neurologic outcome depends not only on the speed of diagnosis but also on the entity and the rate of progression of damage.¹¹ Unfortunately, in our case and in most cases in the literature (9/15 cases, 60%) paraplegia was not relieved by emergency laminectomy; moreover, in 2 cases (13.3%) paraplegia was associated with a fatal outcome.

Aggressive hemostatic maneuvers at the posterior edge of a posterolateral thoracotomy, in proximity of the intervertebral foramen, could create a pleural-epidural or even a pleural-subarachnoid communication through the intervertebral foramen.^{4,6} Drainage during surgery of a clear liquid from intervertebral foramen, that is, cerebrospinal fluid leakage, has been reported by Batellier and associates.⁶ The posterior edge of posterolateral thoracotomy is within millimeters of the spinal cord. Moreover, the intervertebral foramina are not a strong musculo-osseous barrier protecting the spinal cord. Therefore, the weak resistance offered by foramina may be easily worn down, especially if the vertebral bone is malacic, as in our case. Pushed and packed through a pleuroepidural communication, oxidized cellulose gauzes or bone wax may enter the vertebral canal and directly compress the cord. Packed gauzes left in place, preventing the drainage of active bleeding in the pleural cavity, may swell and promote hematoma formation inside the vertebral canal, with consequent spinal cord compression. Hemostatic gauze migration and progressive swelling after chest wall closure and persistent low bleeding with hematoma formation may explain the progressive onset of paraplegia in our case and in some cases in the literature.^{5,7,8}

In conclusion, paraplegia after aortic repair may not always be the result of irreversible spinal ischemia caused by aortic cross-clamping or posterior intercostal artery ligation. Although extrinsic compression by oxidized gauze is an unusual cause of postoperative paraplegia after aortic surgery, it is prudent to maintain an high index of suspicion about this reversible mechanism, particu-

larly if hemostasis in the posterior edge of thoracotomy was difficult during the operation. Close perioperative and postoperative monitoring is imperative to allow detection of early signs of neurologic deterioration. It should be remembered that the onset of neurologic signs may be early or delayed during the postoperative course, and deterioration is more frequently progressive than abrupt. The suspicion of such a causal mechanism should prompt emergency MRI or computed tomography to obtain a diagnosis as soon as possible. The paramount importance of prompt diagnosis and treatment cannot be underscored enough, because the irreversibility of neurologic damage after cord compression is time dependent. Decompression laminectomy should be performed within 8 hours from clinical presentation for the highest probability of neurologic recovery.

References

1. Mauney MC, Blackburn LH, Langenburg SE, Buchanan SA, Kron IL, Tribble CG. Prevention of spinal cord injury after repair of the thoracic or thoracoabdominal aorta. *Ann Thorac Surg.* 1995;59:245-52.
2. Biglioli P, Spirito R, Porqueddu M, Agrifoglio M, Pompilio G, Parolari A, et al. Quick, simple clamping technique in descending thoracic aortic aneurysm repair. *Ann Thorac Surg.* 1999;67:1038-43.
3. de Figueredo LF, Coselli JS. Individual strategies of hemostasis for thoracic aortic surgery. *J Card Surg.* 1997;12(2 suppl):222-8.
4. Perez-Guerra FP, Holland JM. Epidural hematoma as a cause of postpneumectomy paraplegia. *Ann Thorac Surg.* 1984;39:282.
5. Tashiro C, Iwasaki M, Nakahara K, Yoshiya I. Postoperative paraplegia associated with epidural narcotic administration. *Can J Anaesth.* 1987;34:190-2.
6. Batellier J, Wihlm JM, Morand G, Witz JP. Paraplegia due to spinal extradural haematoma after radical pulmonary lobectomy for cancer. *Ann Chir.* 1989;43:210-4.
7. Short HD. Paraplegia associated with the use of oxidized cellulose in posterolateral thoracotomy incisions. *Ann Thorac Surg.* 1990;50:288-90.
8. Wada E, Yonenobu K, Ebara S, Kuwahara O, Ono K. Epidural migration of hemostatic agent as a cause of postthoracotomy paraplegia: report of two cases. *J Neurosurg.* 1993;78:658-60.

Thoracotomy	Neurologic level loss	Onset	Compressing agent	Outcome
Left posterolateral 5th intercostal space	T5	Early	Hematoma	Paraplegia
Right posterolateral	T5	Delayed	Oxidized cellulose gauze	Partial recovery
Left posterolateral	T5	Early	Hematoma	Death
Right posterolateral 5th intercostal space	T5-6	Early	Hematoma and oxidized cellulose gauze	Paraplegia
Right posterolateral 5th intercostal space	T5-6	Delayed	Hematoma and oxidized cellulose gauze	Right leg plegia
Right posterolateral 5th intercostal space	T5-6	Early	Oxidized cellulose gauze	Paraplegia
Right posterolateral 5th intercostal space	T5	Delayed	Hematoma and oxidized cellulose gauze	Partial recovery
Right posterolateral 5th intercostal space	T5	Delayed	Hematoma and oxidized cellulose gauze	Recovery
Left posterolateral	T6-7	NR	NR	Death
Left posterolateral	T6-7	NR	NR	Partial recovery
Left posterolateral	T6-7	NR	NR	Paraplegia
NR	T6-7	NR	NR	Paraplegia
NR	T6-7	NR	NR	Paraplegia
Right posterolateral 5th intercostal space	T5	Early	Oxidized cellulose gauze	Paraparesis
Left posterolateral 5th intercostal space	T8	Early	Oxidized cellulose gauze	Paraplegia

9. Attar S, Hankins JR, Turney SZ, Krsana MJ, McLaughlin JS. Paraplegia after thoracotomy: report of five cases and review of the literature. *Ann Thorac Surg.* 1995;59:1410-6.
10. Iwabuchi S, Koike K, Okabe T, Tago S, Murakami T. Iatrogenic paraplegia caused by Surgicel used for hemostasis during a thoracotomy: report of a case. *Surg Today.* 1997;27:969-70.
11. Lovstad RZ, Steen PA, Forsman M. Paraplegia after thoracotomy—not caused by the epidural catheter. *Acta Anaesthesiol Scand.* 1999;43:230-2.
12. Svensson LG. Hemostasis for aortic surgery. *J Card Surg.* 1997;12(2 suppl):229-31.
13. Mawad ME, Rivera V, Crawford ES, Ramirez A, Breitbach W. Spinal cord ischemia after resection of thoracoabdominal aortic aneurysms: MR findings in 24 patients. *AJNR Am J Neuroradiol.* 1990;11:987-91.
14. Huynh TT, Miller CC, Safi HJ. Delayed onset of neurologic deficit: significance and management. *Semin Vasc Surg.* 2000;13:340-4.
15. Wulf H. Epidural anaesthesia and spinal haematoma. *Can J Anaesth.* 1996;43:1260-71.