

Persistent unilateral right diaphragmatic palsy following liver transplantation

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TO THE EDITOR: We describe two liver transplant patients who presented with unexplained dyspnoea and were subsequently found to have unilateral right diaphragmatic palsy, an uncommon complication of orthotopic liver transplantation.¹⁻³

Both transplant recipients were male. One, aged 64 years, had a liver transplant in 2005 for hepatitis C-related chronic liver disease. The other, aged 66 years, had a liver transplant in 2004 for end-stage alcoholic liver cirrhosis. Both patients had presented with exertional dyspnoea several weeks after transplantation. Both were reformed smokers with no prior respiratory symptoms or established respiratory or cardiac condition.

Preoperative pulmonary function tests had been essentially normal in both patients (Box 1). Chest x-rays of both patients during the postoperative convalescence period showed unilateral elevation of the right hemidiaphragm compared with the immediate pre-transplant images. (Images for Patient 1 are shown in Box 2.) Fluoroscopic study (the "sniff test") and a computed tomography scan of the chest confirmed the presence of right hemidiaphragmatic palsy in both patients.

Follow-up chest x-rays and pulmonary function tests over 2 years showed no significant improvement. In both patients, the postoperative clinical course over these 2 years was characterised by recurrent hospital admissions with hypoxaemia and intercurrent respiratory tract infections, some requiring supplemental oxygen therapy, non-invasive positive pressure ventilation and invasive ventilation in the intensive care unit. Currently, one of these

patients is well, apart from dyspnoea on moderate exertion. The other patient died from a cause unrelated to his diaphragmatic palsy.

Unilateral diaphragmatic palsy following liver transplantation is thought to be related to traumatic crush injury to the right phrenic nerve from a clamp placed on the inferior vena cava (IVC) during surgery.¹ The proximity of the phrenic nerve to the IVC renders it very vulnerable to this type of injury from side-to-side cross-clamping of the suprahepatic IVC.^{1,2}

In 2008, we modified our technique to avoid cross-clamping of the IVC by performing cavocavostomy, a type of "piggyback" technique that involves "side-biting" (partial clamping) of the retrohepatic IVC away from the diaphragm.⁴

Unilateral diaphragmatic palsy can reduce exercise tolerance⁵ and may place additional mechanical stress on ventilation, which could exacerbate hypoxaemia if these patients develop intercurrent pulmonary infections.

Reporting on a series of patients with phrenic nerve injury after liver transplantation, McAlister and colleagues¹ found right hemidiaphragmatic palsy in 38% of patients after transplantation, but most of the patients recovered their diaphragmatic function within 9 months. In contrast, our patients did not show any signs of recovery for over 2 years, indicating that loss of diaphragmatic function after liver transplantation may be longstanding or permanent.

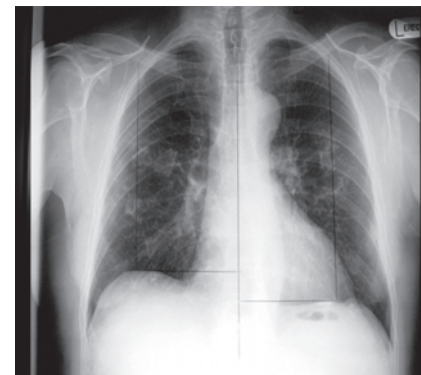
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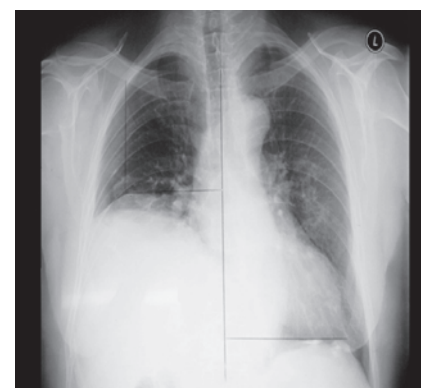
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2 Erect chest x-rays before and after orthotopic liver transplantation, Patient 1



A: In 2005, before liver transplant.



B: In 2006, 6 months after liver transplant. Note marked elevation of the right hemidiaphragm and presence of bilateral calcified pleural plaques. ♦

1 McAlister VC, Grant DR, Roy A, et al. Right phrenic nerve injury in orthotopic liver transplant. *Transplantation* 1993; 55: 826-830.

2 Gurakar A, Hassanein T, Van Thiel DH. Right diaphragmatic paralysis following orthotopic liver transplantation [abstract]. *J Okla State Med Assoc* 1995; 88: 149-153.

3 Manczur TI, Greenough A, Rafferty GF, et al. Diaphragmatic dysfunction after pediatric orthotopic liver transplantation. *Transplantation* 2002; 73: 228-232.

4 Mehrabi A, Mood ZA, Fonouni H, et al. Single-center experience of 500 liver transplants using the modified piggyback technique by Belghiti. *Liver Transpl* 2009; 15: 466-474.

5 Laroche CM, Mier AK, Moxham J, Green M. Diaphragm strength in patients with recent hemidiaphragm paralysis. *Thorax* 1988; 43: 170-174. □

1 Comparison of pulmonary function tests before and after orthotopic liver transplantation*

Pulmonary function test	Patient 1			Patient 2		
	Before transplant	After transplant	Difference	Before transplant	After transplant	Difference
FEV ₁ (% of predicted)	2.72 L (80%)	1.73 L (51%)	-29%	2.78 L (85%)	1.40 L (47%)	-38%
FVC (% of predicted)	3.79 L (87%)	2.41 L (56%)	-31%	3.83 L (92%)	2.17 L (57%)	-35%
FEV ₁ /FVC	0.72	0.72		0.73	0.65	
TLC (% of predicted)	5.81 L (87%)	4.28 L (62%)	-25%	7.09 L (110%)	5.18 L (86%)	-24%

FEV₁ = forced expiratory volume in 1 second. FVC = forced vital capacity. TLC = total lung capacity.

* Tests were performed while the patients were in a clinically stable condition. ♦

Correction

Incorrect author name: In the letter "Invasive pneumococcal disease in Western Australia: emergence of serotype 19A", in the 2 February 2009 issue of the Journal (*Med J Aust* 2009; 190: 166), there was an error in one of the authors' names. The name "Keil D Anthony" should have been "Anthony D Keil". □