



decompression of the left hemithorax was carried out.

The patient's condition started deteriorating immediately and he became more tachypnoeic and dyspnoeic, with an oxygen saturation of 88%. A chest drain was inserted on the left side, but the patient became increasingly hypoxic, had seizures and progressed to a Pulseless Electrical Activity cardiac arrest. Cardiopulmonary resuscitation was started and the trachea intubated. With ongoing resuscitation, an ultrasound examination of the heart, using a 7 MHz linear ultrasound probe (SonoSite®; Bothell, Washington, DC, USA), showed no evidence of cardiac tamponade and examination of the both anterior lung fields showed an absence of sliding of the pleura on the right side indicating a possible pneumothorax. Based on this, a chest drain was immediately inserted on the right side and the patient had a return of spontaneous circulation within one resuscitation cycle of chest drain placement. The arrest lasted approximately 10 min. A review of the initial X-ray revealed that it was wrongly labelled for laterality and the initial needle decompression and chest drain had been performed on the wrong side. The patient made an uneventful recovery. A subsequent CT scan showed extensive bullous disease.

In normal subjects when an ultrasound of the chest is done, the interface between the soft tissues of the chest wall and the aerated lung creates a hyper-echogenic line which moves in synchrony with respiration; the lung sliding sign. The sign disappears when there is a pneumothorax. Based on the absence of the sliding sign, Soldati et al. [3] report a 92% sensitivity and 99.4% specificity for diagnosing occult pneumothoraces when compared to the gold standard of spiral CT, whereas chest X-ray had 52% sensitivity and 100% specificity. Ultrasound guided diagnostic imaging is already a part of the assessment abdominal trauma in adult trauma life support (ATLS® Royal College of Surgeons of England, London, UK). Outside this however, its use in emergency situations seems to be fairly limited. The majority of life threatening conditions occur out of hours, when immediate expert help in

imaging techniques is unavailable. In our case, the trainee involved was trained in ultrasound techniques and this proved decisive in the successful resuscitation.

Currently, ultrasound equipment may not be readily available everywhere that in-hospital cardiac arrests occur. Training trainees operating in areas where it is available would improve confidence and readiness to use ultrasound imaging in emergencies. This would decrease our reliance on radiography, replacing it with the quicker, less cumbersome technique that is ultrasound imaging.

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### References

- 1 Hernandez C, Shuler K, Hannan H, et al. C.A.U.S.E.: Cardiac arrest ultrasound exam—a better approach to managing patients in primary non-arrhythmogenic cardiac arrest. *Resuscitation* 2008; **76**:198–206.
- 2 Lichtenstein DA, Mezière GA. Relevance of lung ultrasound in the diagnosis of acute respiratory failure: the BLUE protocol. *Chest* 2008; **134**: 117–25.
- 3 Soldati G, Testa A, Sher S, et al. Occult traumatic pneumothorax: diagnostic accuracy of lung ultrasonography in the emergency department. *Chest* 2008; **133**: 204–11.

### Cardiopulmonary exercise testing diagnosis of myocardial suppression

In our pre-operative assessment clinic we risk-stratify patients using Cardiopulmonary Exercise Testing (CPET) as described by Older [1]. Individuals with an anaerobic threshold less than 8 ml O<sub>2</sub>.kg<sup>-1</sup>.min<sup>-1</sup> are considered to have a high peri-operative risk for major vascular surgery.

An elderly male presented for assessment prior to complex open surgery to multiple intra-abdominal aneurysms.

His past medical history consisted of infrequent attacks of paroxysmal atrial fibrillation for which he took aspirin, warfarin, and disopyramide 100 mg three times daily (for over 30 years).

He had no history of cardiac disease and reported a good exercise capacity of over 4 METS. He had a Body Mass Index of 20.9 kg.m<sup>-2</sup>, resting oxygen saturations of 98% (on air) and a resting blood pressure and heart rate of 130/77 mmHg and 72 beat.min<sup>-1</sup> (sinus rhythm) respectively. ECG, lung function tests and routine blood investigations were all within normal predicted limits.

CPET was performed to further demarcate risk. The gentleman exercised using a 20 watt.min<sup>-1</sup> ramped protocol, until he achieved his peak oxygen uptake (VO<sub>2</sub> Peak) when the test was terminated due to exhaustion. CPET measurements were markedly reduced from predicted values: VO<sub>2</sub> peak 8.7 ml O<sub>2</sub>.kg<sup>-1</sup>.min<sup>-1</sup> (predicted 28 ml O<sub>2</sub>.kg<sup>-1</sup>.min<sup>-1</sup>), anaerobic threshold 5.4 ml O<sub>2</sub>.kg<sup>-1</sup>.min<sup>-1</sup> (predicted 14 ml O<sub>2</sub>.kg<sup>-1</sup>.min<sup>-1</sup>), maximum heart rate 85 beat.min<sup>-1</sup> (predicted 145 beat.min<sup>-1</sup>). He achieved a ventilatory equivalents value carbon dioxide (VE/VCO<sub>2</sub>) of 34 at anaerobic threshold, and examination of the nine panel plot strongly suggested dynamic left ventricular impairment during exercise. There was no demonstrable cardiac ischaemia on continuous 12-lead ECG monitoring. These results were unanticipated, and classified him as high risk for the proposed surgery. We then assessed resting left ventricular performance with a transthoracic echocardiogram: this revealed normal left ventricular function with a mildly dilated aortic root.

Disopyramide prolongs the duration of the action potential in myocardial cells exerting a negative inotropic effect causing depression of myocardial contractility [2, 3]. In the absence of an alternative cause for the poor CPET performance we stopped disopyramide, hoping to reverse the myocardial depression. On cardiological advice low dose bisoprolol was started as prophylaxis for paroxysmal atrial fibrillation.

Two weeks after stopping disopyramide repeat CPET demonstrated a significant improvement: VO<sub>2</sub> Peak 14.0 ml O<sub>2</sub>.kg<sup>-1</sup>.min<sup>-1</sup>, anaerobic threshold

10.0 ml O<sub>2</sub>.kg<sup>-1</sup>.min<sup>-1</sup> and VE/VCO<sub>2</sub> at anaerobic threshold of 28. Discontinuing disopyramide allowed an appropriate increase in cardiac output and improved oxygen uptake during CPET. There was no change in maximal heart rate after starting the bisoprolol, demonstrating that improved contractility and stroke volume were responsible for the increased cardiac output. This substantial improvement in aerobic capacity allowed the patient to be reclassified risk moderate in Older's criteria [1].

Despite reclassification of risk however, on further consideration of the complexity of surgery and the patient's age, open surgery was deemed inappropriate. The gentleman had an uneventful endovascular intervention.

This case highlights the value of dynamic objective exercise testing whilst also exposing the limitations of resting studies such as transthoracic echocardiography. We successfully altered an individual's risk for surgery in a short time, based on the CPET results. CPET can assist us with diagnosis as well as risk stratification: a low anaerobic threshold has prompted the search for a new diagnosis on numerous occasions in patients thought to be fit before objective testing. Furthermore, this reminds us that anti-arrhythmic drugs can cause myocardial suppression and that many older cardiac drugs have been superseded by drugs with improved side effect profiles.

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## References

- Older P, Hall A, Hader R. Cardiopulmonary exercise testing as a screening test for perioperative management of major surgery in the elderly. *Chest* 1999; **116**: 355–62.
- Pfisterer M. Negative inotropic effects of antiarrhythmic drugs: a clinical point of view. *Journal of Cardiovascular Pharmacology*, 1991; **17** (Suppl 6): S44–7.
- British National Formulary No. 56. London, UK: BMJ Group and RPS Publishing, September 2008.

## Phaeochromocytoma in a developing country

Phaeochromocytomas are catecholamine secreting tumours of chromaffin cells. Around 15% are extra-adrenal, and up to 40% of these may be malignant [1]. There are many case reports of different anaesthetic techniques [2, 3], but we have not found any describing a technique suitable for developing countries.

We would like to describe a case of presumed phaeochromocytoma presenting for surgery in Tanzania. A young 60-kg woman presented with blurred vision. On examination she had grade IV fundoscopic changes with hypertension. Ultrasound showed a right supra-renal mass, 55 × 54 mm, with normal kidneys, liver and spleen. She had left ventricular hypertrophy and inferior ischaemic changes on her ECG. A presumptive diagnosis of phaeochromocytoma was made, but neither urine vanillylmandelic acid nor blood catecholamine levels were available. She was pregnant at the time of diagnosis and surgery was therefore postponed. The patient miscarried at 8 weeks' gestation.

She re-presented 5 months later with abdominal pain and vomiting, with a blood pressure of 180/130. She received nifedipine and captopril before being referred to the urologists for surgery. One unit of blood was donated for autologous transfusion peri-operatively.

There are problems with the supply chain for many drugs in developing countries. Phenoxybenzamine was obtained, which she received for one week pre-operatively in a dose of 10 mg tds. The day before surgery, propranolol 20 mg tds was added and oral fluid intake encouraged. Pethidine 75 mg and diazepam 10 mg IM were given 1 h pre-operatively. Monitoring consisted of ECG, non-invasive blood pressure (set to take once every 2.5 min, but able to check continuously), pulse oximetry and a pre-cordial stethoscope. Anaesthesia was induced with lignocaine 60 mg, propofol 150 mg and pancuronium 4 mg. The lungs were hand ventilated with isoflurane 2% in 100% O<sub>2</sub> for 3 min before intubation, which was uneventful. Maintenance was with isoflurane 1–2% in 100% O<sub>2</sub>.

Drugs available to control hypertension consisted of hydralazine, pethidine, labetalol, and isoflurane; with adrenaline and ephedrine for hypotension.

Intra-operatively the patient was tachycardic at a rate of around 120 beat.min<sup>-1</sup>, and there were three major periods of hypertension during tumour manipulation. These were immediately and effectively controlled with a combination of increased isoflurane, 30-mg propofol boluses, and 25-mg pethidine boluses. Unfortunately, during the six months since diagnosis the tumour had spread and was found to be adherent to the inferior vena cava and the sympathetic chain. It was deemed inoperable, a biopsy was taken and surgery terminated. The patient was taken to Intensive Care intubated but breathing spontaneously on a T-piece. She was extubated the following morning and continued to improve until discharge 18 days later.

Most case reports of phaeochromocytoma involve invasive arterial pressure, central venous pressure and often cardiac output monitoring. These are not available in many hospitals in the developing world. Capnography and gas analysis were also unavailable. Setting a non-invasive blood pressure machine to 'continuous' mode produced a reading approximately every 30 s. A pre-cordial stethoscope and a finger on the pulse allowed the quality of the heart beat to be assessed, giving some indication as to the adequacy of filling. Some drugs are not available – either because they have to be bought individually by the patient, or, as in this case, because two of the drugs (hydralazine and phenoxybenzamine) had to be purchased from a distant town. However, with careful planning, alternatives may be found.

Finally, it is often difficult to obtain up to date information on the best techniques for anaesthesia. We are grateful for 'Anaesthesia 3' resource CDs, obtainable through TALC (<http://www.talcuk.org>) and sponsored by the Association of Anaesthetists of Great Britain and Ireland which contain not only tutorials, but also back copies of *Anaesthesia* for our reference.