- 1 Knotting of the guide wire.
- 2 Partial or complete separation of a portion of the wire and embolization or displacement of the catheter tip.
- 3 Vascular injury particularly from the rough irregular surfaces of a damaged wire.

These two cases are further examples of problems attributable to guide wires. To minimize the incidence of complications, it is recommended that wires be inspected, treated as delicate instruments, sufficiently large skin incisions be made to minimize multiple manipulations and they should not be reused. Should difficulty in removing a guide wire be encountered, no effort should be made to remove it until preparations for urgent thoracotomy are complete, in case devastating intrathoracic bleeding is encountered on withdrawal.

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Extrapleural haematoma after jugular vein cannulation

To the Editor:

Cannulation of the internal Jugular vein (IJV) is common practice in our hospital for major surgery. Recently we have encountered two cases with an extrapleural haematoma after an apparently uncomplicated IJV catheterization. The first case was a 66-yr-old woman, who was scheduled for a laparotomy. After induction of anaesthesia, the right IJV was catheterized, using a Seldinger technique and a single lumen catheter. We succeeded at the first attempt. The second case was a 57-yr-old man, also scheduled for a laparotomy. In this case we used a double-lumen catheter. After locating the IJV with a #22-gauge needle,

FIGURE Extrapleural haematoma with "extrapleural sign" (case #2).

cannulation was performed at the first attempt. In both cases blood returned on lowering of the infusion bottle and a typical CVP curve was registered. Both operations were Uneventful. In both cases a postoperative chest x-ray showed a shadow projecting over the top of the right lung (Figure). An extrapleural haematoma was diagnosed in both patients. The bleeding was probably caused by a lesion of the vessel wall or could have occurred while exchanging the needle for the catheter. Because there were no blood coagulation abnormalities and arterial puncture was improbable, we decided on a conservative approach. In the second case the correct position of the catheter was confirmed by injecting contrast under x-ray control. In both cases the haematoma disappeared within two weeks.

The extrapleural space is a preferential site for haematoma formation, because it is subjected to negative intrathoracic pressure. Due to the plano-convex configuration of an extrapleural fluid collection, the projection on a CXR depends on the location of the haematoma.¹ An apical or lateral haematoma will show a sharp convex border with tapering corners, the so-called "extrapleural sign."² A posterior or anterior haematoma will show this sign on a lateral x-ray only. An extrapleural haematoma can be confused with haemothorax, pulmonary infiltration, or atelectasis. Puncture of the haematoma is not indicated, as this leads to a haemothorax and tamponade.

Most cases of extrapleural haematoma will not be recognized unless a chest x-ray is taken after every IJV catheterization.

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Negative arterial to end-tidal gradients

To the Editor:

We read with interest the article by Drs. Russell, Graybeal and Strout.¹ May we be permitted to comment on this subject.

Firstly, in the introduction, the authors state that the $P(a-ET)CO_2$ is primarily a reflection of respiratory deadspace, increasing as deadspace increases. This was an earlier belief but it has now been shown to be no longer true.^{2,3} The relation between the two variables ($PaCO_2$ and $PETCO_2$) is complicated, being determined by the slope of the "alveolar plateau," phase III of single breath test. It has been shown that alveolar deadspace increased by the end of cardiac bypass surgery, but so too had the slope of phase III resulting in no significant change in $P(a-ET)CO_2$.^{3,4} Thus, increasing the alveolar deadspace may not increase $P(a-ET)CO_2$. Furthermore, $P(a-ET)PCO_2$ values may be negative or zero as a normal physiological variant during anaesthesia,⁵ exercise,⁶ or in pregnancy^{7–9} in the presence of a significant alveolar deadspace.

Secondly, $PETCO_2$ measurements were corrected for humidity, but not for the effect of positive airway pressure. With some capnometers positive airway pressure influences the $PETCO_2$ measurements. Therefore the measurements should be corrected for the presence of positive airway pressures.

Thirdly, the authors have expressed a doubt that the meaning of negative $P(a-ET)PCO_2$ is not totally clear. We think that the recent literature on this subject should clear any doubts.^{2,5,7–9} Negative (a-ET) PCO_2 values were observed more than 30 yr ago by Nunn *et al.*¹⁰ although no explanation was offered at that stage. Fletcher *et al.*

observed negative or zero (a-ET) PCO_2 values in 12% of non-pregnant patients during anaesthesia/IPPV using large tidal volumes and low frequencies.⁵ Increases in tidal volumes and low frequency result in (i) gas emptying from slow alveoli can reach the mouth, whereas it would have remained in the airways with small tidal volumes; (ii) relatively better ventilation of dependent, well-perfused alveoli. Under these circumstances the low $\dot{V}/\dot{Q}$ compartments (alveoli with higher CO_2 concentrations) make a more substantial contribution to gas exchange. Normally, there are differences in the emptying patterns among various compartments in the lung. Therefore, more gas with an above average alveolar PCO_2 can now reach the airway opening from "late" or "slow" compartments. This results in $PETCO_2$ exceeding mean $PaCO_2$. On a capnogram, the slope of phase III crosses the mean $PaCO_2$ (alveolar PCO_2).¹¹ The physiological changes in pregnancy increase the number of alveoli with low $\dot{V}/\dot{Q}$ ratios (alveoli with high CO_2 concentration). Therefore we stated that there is increased incidence of negative (a-ET) PCO_2 values in pregnancy.^{7–9}

After CPB, one may expect a range of ventilation/perfusion mismatching. There is a reduction of functional residual capacity and haemodilution following CPB.^{4,12} These may result in several alveoli with low $\dot{V}/\dot{Q}$ ratios (alveoli with higher CO_2 concentration). Because the tendency to airway closure is increased after CPB, these alveoli do not have a chance to empty. However, with the use of high tidal volume ventilation and added PEEP alveoli with high CO_2 concentration are now allowed to empty and thus contribute to an increased phase III slope and higher $PETCO_2$. This may result in negative (a-ET) PCO_2 values as were observed in the study by Russell *et al.*¹

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