**Risk of Pulmonary Embolus with Catheter Removal**

**Question:**

What is the risk of pulmonary emboli (PE) when removing central venous catheters? Is the risk greater when a deep vein thrombosis has been diagnoses? Our current policy requires removal in the Radiology Department following ultrasound, however this is not always possible. The nursing staff is refusing to remove these lines when clinical signs and symptoms of DVT are present.

**Answer:**

Many published studies have documented that the incidence of upper extremity DVT is increasing. Of all upper extremity DVTs diagnosed, about 30-40% are attributed to the presence of some type of central venous catheter. Pulmonary emboli can occur when the catheter is removed, but it may also happen during the dwell time of the catheter, with and without clinical signs and symptoms.

A multi-center study in critical care patients found 69 of 208 (33%) patients with catheter-related thromboses from internal jugular and subclavian inserted catheters. Diagnosis of thrombus was made by color Doppler ultrasound immediately before removal or within 24 hours after catheter removal. None of these patients presented with clinical signs or symptoms of DVT.

Reports indicate about 12% of all upper extremity DVTs results in PE. One prospective study of 86 patients had catheter-related upper extremity DVT diagnosed with venography, ultrasound or both. Of these 86, 13 patients had PE confirmed by positive lung scan. Of these 13, only 4 had clinical signs and symptoms of PE. When DVT was diagnosed, the patient was started on heparin infusion. Two patients died suddenly within a week after the heparin was begun and massive PE was found on autopsy. This study did not report when the CVC was removed. So no conclusions can be made about whether the risk is greater at removal or during dwell of the catheter.

The risk of catheter-related DVT and subsequent PE is related to numerous factors including the catheter's initial tip location, degree of vein trauma during insertion and dwell, and hypercoagulability of the patient. We tend to think that the risk for PE would be greater during removal of the catheter, but no studies document this. Based on the studies we do have, I believe your nursing staff is currently removing central venous catheters with clinically silent upper extremity DVT. There may also be patients with small PE that do not produce any signs of respiratory distress.

When the patient has clinical signs and symptoms of upper extremity DVT, there is no clear evidence to support the best management technique. Alternatives include catheter removal with no further treatment, catheter removal with anticoagulant therapy, anticoagulation using the symptomatic catheter, and thrombolytic infusion through the symptomatic catheter. Since the incidence of PE is not limited to those situations with

documented evidence of DVT, all nurses removing central venous catheters should be prepared to immediately manage the situation if respiratory distress occurs.

Your current practice of removing symptomatic catheters while the patient is in the Radiology Department presents challenges. What happens when these symptoms are found when a radiologist is not available in the department after regular hours? Your choices could be to have the attending physician remove the catheter at the bedside rather than the nurse or to have the patient wait until the regular working hours of the Radiology Dept for removal. The diagnostic ultrasound would provide information about the size and location of the DVT prior to catheter removal.

I would recommend establishing a collaborative network including key physicians, vascular access nurses and risk managers to determine necessary changes in your current policies on catheter removal and the immediate actions to take when PE is suspected. Given the fact that PE and many other negative outcomes can be associated with catheter removal, I would identify the clinical experience required for nurses to accept this task. Should this task be limited to only IV nurses, only nurses with some degree of advanced experience, or will all nurses in your facility be expected to perform this task?

Other negative outcomes occurring with removal of central venous catheters including catheter emboli, air emboli, and bleeding. Your policy, procedures, and practice guidelines should also include appropriate actions to prevent and manage these complications. I would recommend additional education and documented competency assessment for the nurses expected to perform catheter removal, regardless of what experience level is required to perform the procedure.

Your task force may want to review these references when making their final decisions.

1. Monreal, M., Lafoz, E., Ruiz, J., Valls, R., & Alastrue, A. (1991). Upper-extremity deep venous thrombosis and pulmonary embolism: A prospective study. Chest, 99(2), 280-283.

2. Black, M. D., French, G. J., Rasuli, P., & Bouchard, A. C. (1993). Upper extremity deep venous thrombosis: Underdiagnosed and potentially lethal. Chest, 103(6), 1887-1890.

3. Monreal, M., Raventos, A., Lerma, R., Ruiz, J., Lafoz, E., Alastrue, A., & Llamazares, J. (1994). Pulmonary embolism in patients with upper extremity DVT assocaited to venous central lines - A prospective study. Thrombosis and Haemostasis, 72, 548-550.

4. Stephens, M. B. (1997). Deep venous thrombosis of the upper extremity. American Family Physician, 55(2), 533-539.

5. Marinella, M., Kathula, S., & Markert, R. (2000). Spectrum of upper-extremity deep venous thrombosis in a community teaching hospital. Heart & Lung, 29(2), 113-117.

6. Luciani, A., Clement, O., Halimi, P., Goudot, D., Portier, F., Bassot, V., Luciani, J., Avan, P., Frija, G., & Bonfils, P. (2001). Catheter-related upper extremity deep venous thrombosis in cancer patients; A prospective stud based on doppler US. Radiology, 220(3), 655-660.

7. Timsit, J., Farkas, J., Boyer, J., Martin, J., Missit, B., Renaud, B., & Carlet, J. (1998). Central vein catheter-related thrombosis in intensive care patients: Incidence, risk factors, and relationships with catheter-related sepsis. Chest, 114(1), 207-214.

8. Leebeek, F., stadhourders, N., Stein, D. v., Gomez-Garcia, E., & Kappers-Klunne, M. (2001). Hypercoagulability states in upper-extremity deep venous thrombosis. American Journal of Hematology, 67, 15-19.

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