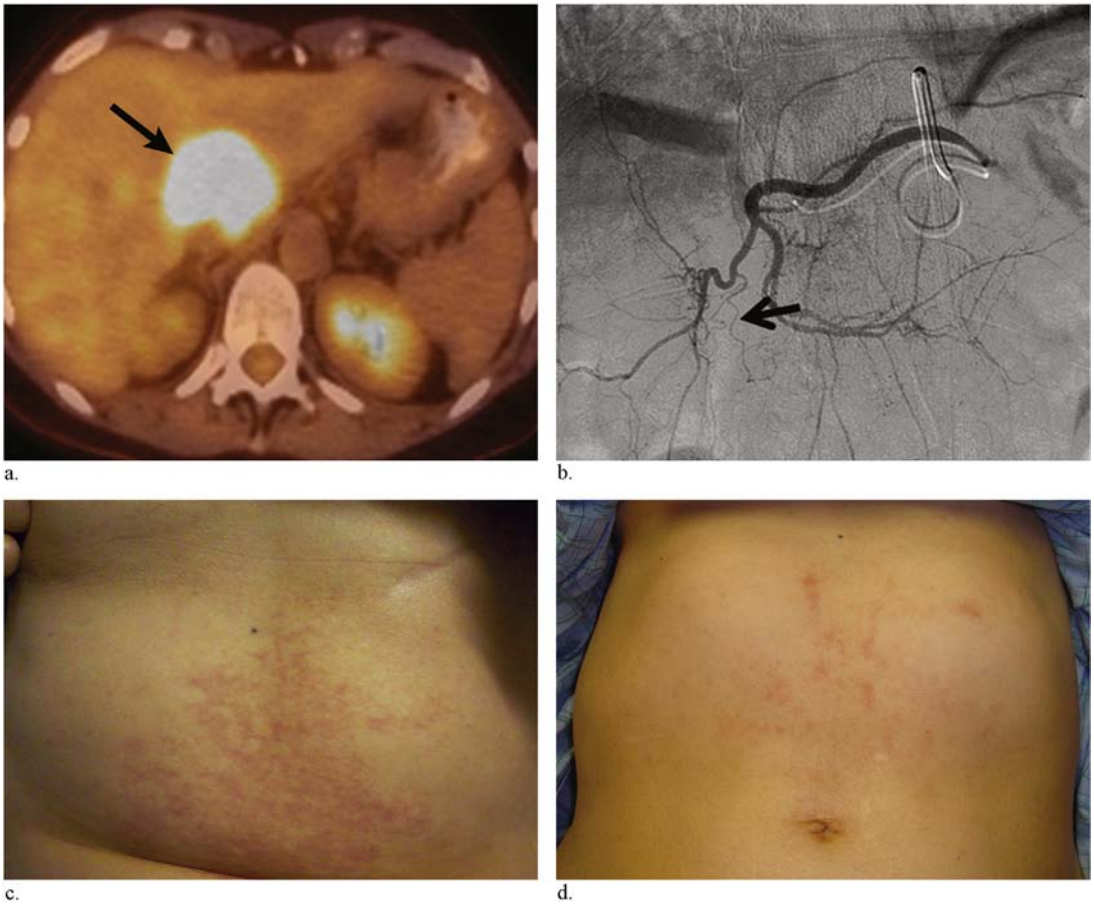

Figure. **(a)** Positron emission tomography scan of the liver shows hypermetabolic liver metastasis (arrow). **(b)** Angiography of the left hepatic artery shows falciform artery (arrow). **(c)** Supraumbilical rash that appeared 2 hours after the initial radioembolization. **(d)** Marked resolution of the rash 30 days after the initial radioembolization. (Available in color online at *www.jvir.org*.)

be present there before stasis is noted during the procedure. The dosing of radiospheres depends on the tumor burden to the liver and is not modified if the falciform artery is observed. The literature suggests that supraumbilical skin changes, which are common with chemoembolization, are rarely seen with radioembolization, although the reported incidence of falciform artery patency is the same (2).

To avoid potential adverse risks related to inadvertent nontarget administration of ^{90}Y, embolization of the falciform artery should be performed whenever the artery is seen (3). Although we did not use this approach, Wang et al (4) have suggested prophylactic use of topically applied ice as a means to prevent cutaneous complications of nontarget chemoembolization and radioembolization when embolization of the falciform artery cannot be achieved.

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Sudden Death from Carcinoid Crisis during Image-Guided Biopsy of a Lung Mass

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Editor:

Occurrence of a carcinoid crisis during interventional radiology procedures is a rare life-threatening complication that arises in patients with carcinoid tumors. Whereas its presentation may be difficult to distinguish from other causes of cardiopulmonary arrest, it has unique, well known clinical manifestations that include cutaneous flushing, bronchoconstriction, cyanosis, tachycardia, and hypotension (1). A combination of these symptoms can be fatal. The crisis may be triggered by stress, use of catecholamine-based drugs, or tumor manipulation.

Presented here is a case of a fatal outcome—"death on the table"—from a crisis that developed suddenly during image-guided biopsy of a carcinoid lung mass in the radiology department.

A 48-year-old man was referred to the interventional radiology unit for image-guided biopsy of a large right lung mass. The patient had been treated for asthma for the previous 5 years and had also recently completed pulmonary tuberculosis treatment at an outside general medical facility based on reported chest radiographic findings (**Fig 1**). The patient was a known smoker of more than 20 pack-years.

Computed tomography (CT) of the chest performed a day before the biopsy showed a large right lung parenchymal mass compressing the right main bronchus, with resultant collapse of the right lower lobe (**Fig 2**). The mass abutted the right lower pleura and was clearly visible on ultrasound (US) (**Fig 3**). The mass was thought to be bronchogenic carcinoma in view of the history of chronic smoking. The findings of preprocedural baseline blood tests were within normal limits. Baseline vital signs were within normal limits (135/80 mm Hg; oxygen saturation of 99% on room air; pulse rate of 76 beats/min).

After signed written consent was obtained, the patient was placed in the prone position on the biopsy table, 1 mg of midazolam was given intravenously for light conscious sedation, and the skin point of entry was cleaned and infiltrated with 10 mL of lignocaine, a local anesthetic agent. An 18-gauge automatic biopsy needle (Tru-Core; Angiotech, Vancouver, British Columbia, Canada) was then inserted into the mass under US guidance, and optimal position was confirmed with CT. Dyspnea immediately developed at this time, with loud audible wheezing in keeping with bronchial constriction. This rapidly progressed within minutes to status asthmaticus unresponsive to intravenous aminophylline boluses. This, together with decreasing oxygen saturations of 20%–25% on facial mask oxygen, necessitated intubation of the patient. Blood pressure significantly decreased to 60/25 mm Hg and could not be recorded at the time of intubation. In view of the sudden exacerbation of symptoms and a quick correlation of the patient's history, a carcinoid crisis was suspected.

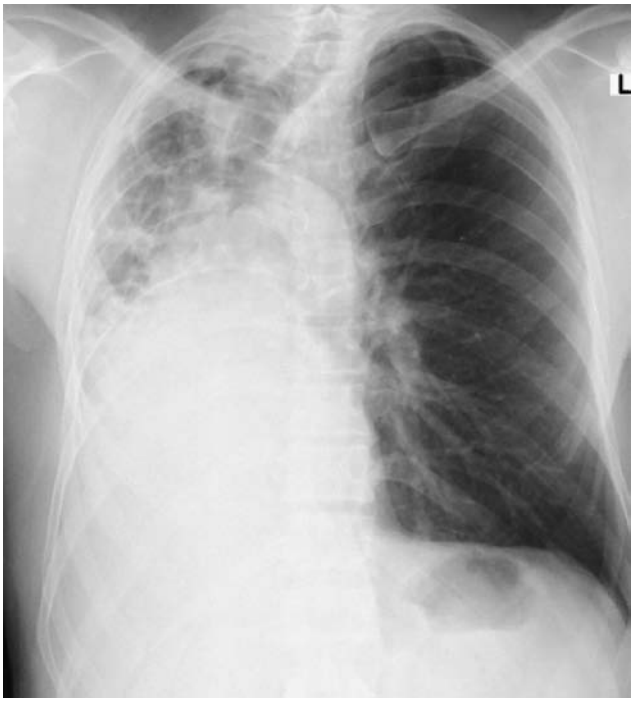

Figure 1. Posteroanterior chest radiograph obtained 1 day before biopsy shows volume loss of the right lung with resultant tracheal and mediastinal shift to the right.

The resuscitation team was alerted to specific resuscitation with octreotide and ketanserin intravenous regimens in addition to routine cardiopulmonary resuscitation. These were not immediately available, and the patient was pronounced dead after extended cardiopulmonary resuscitation. An on-table CT scan during resuscitation showed minimal air in the center of the mass and along the needle tract. There was no air embolism seen in the pulmonary arterial vasculature or aorta.

At postmortem examination, a firm, whitish, gritty right lung mass was seen (**Fig 4**). It invaded the lumen of the right main bronchus, with a large extrabronchial component. There was no pneumothorax or hemothorax. No air embolism was seen in the pulmonary vasculature or aorta. Emphysematous changes of the right upper lung were noted. Histologic sections and immunohistochemical staining confirmed a carcinoid tumor (**Fig 5**). Results of 24-hour urine test done a day before biopsy, which became available after the patient's death, showed elevated levels of the serotonin metabolite 5-hydroxyindoleacetic acid of 34 mg/d (normal, < 9 mg/d).

The biopsy needle was thought to have likely triggered release of vasoactive substances from the tumor. It is postulated that there was a release of histamine to account for the severe bronchoconstriction and serotonin to account for the hypotension (3). Immediate onset of the crisis symptoms rarely happens, as lung carcinoid tumors are thought to be largely inactive. It is believed that this is the first case in the literature detailing a fatal outcome from a percutaneous biopsy of a lung carcinoid tumor.