Minimally Invasive Diagnosis

Percutaneous biopsy of solid tumor malignancies is common in adult medicine and has not caught on in centers outside of major pediatric oncology practices. Percutaneous biopsy of Ewing sarcoma family of tumors (ESFT) \[^1\] , neuroblastoma \[^2\] and chest lesions \[^3\] was quite successful at the Children’s Hospital in Boston and successfully obtained diagnostic and prognostic information from cytogenetics \[^4\] including the t(11;22) of ESFT, fluorescent in site hybridization techniques for neuroblastoma MYCN amplification and flow cytometry for DNA index. Percutaneous biopsy of solid tumors was the subject of a fine paper from Great Ormond Street Hospital for Children at last years SIOP meeting \[^5\] . At St. Jude Children’s Research Hospital, the interventional radiologist does more tumor biopsies than any surgeon \[^6\] . Molecular pathology and immunohistochemistry have advanced the diagnostic powers of imaging guided needle biopsies. Many pediatric centers are slow to catch on due to inadequate tissue by non-aggressive radiologists or due to reluctant pathologists and aggressive surgeons. Many core specimens from 15 or 16 gauge needles obtain sufficient material with minimal risk. Shimada \[^7\] has required incisional biopsies for his neuroblastoma classification as favorable or unfavorable. However, the MK index can be determined from a needle specimen and the gross pathology from diagnostic imaging. Hopefully the new International Neuroblastoma Staging System presented at this meeting will not require open biopsy.

Percutaneous biopsy of the lung and transjugular biopsy liver \[^8, 9\] have offered relatively safe methods to diagnose infections and other complications of cancer treatment.

Fluid aspiration of hematologic malignancies of non-Hodgkin lymphoma (NHL) and leukemia is the next logical diagnostic step after bone marrow aspiration \[^10\] . Flow cytometry can characterize the B or T cell type of the blasts from this fluid. If this step fails to be diagnostic, core needle biopsy will most often succeed and often catches the Reed Sternberg cell needed to diagnose Hodgkin lymphoma or immunohistochemistry for the NHL.

Fine needle aspiration (FNA) of thyroid nodules after radiotherapy may be able to differentiate the malignant papillary carcinoma but may be unable to differentiate normal follicular cells from an adenoma or carcinoma. Thyroid lesions that are over 1 cm in size or that are symptomatic may benefit from FNA \[^11\] .

Needle localization of small tumors for surgical diagnostic or therapeutic resection \[^12\] may be necessary for musculoskeletal lesions, lymph nodes or lung nodules especially if the minimally invasive thoracoscopic techniques are used. However, ultrasound guided biopsy of pleural based nodules \[^13\] has been successful in lesions as small as 2 mm. Perhaps the interventional radiologist can simply ablate these lesions in the future.

Minimally invasive treatment

Thermal ablation of pediatric malignancies using radiofrequency ablation (RFA) is in a Phase I study at St. Jude Children’s Research Hospital \[^14-16\] . This technology is widely used in adults for hepatocellular carcinoma or colon metastases in the liver. I have successfully ablated rhabdomyosarcoma, adenocarcinoma of the colon, pancreatoblastoma and fibrolamellar hepatocellular carcinoma of the liver (unpublished) but only the last patient remains alive. It is largely a palliative treatment but may lengthen the patient’s life with limited toxicity. The liver regenerates. Large lesions may benefit from chemoembolization prior to RFA.
Lung RFA is becoming more common in adult patients than liver RFA treating both lung metastases and primary adenocarcinoma of the lung. I have treated 12 patients with pediatric acquired disease (unpublished) metastatic to the lung. The inclusion criteria include a prior thoracotomy. Since 90% of osteosarcomas recur in the lung after a thoracotomy and 50% recur in the scar, there is room for improvement [17]. I have treated mainly patients with osteosarcoma including one pediatric patient with ablated pulmonary metastases who is alive and well at 25 months post first RFA. Other pulmonary metastases ablated include Wilms tumor, synovial sarcoma, hepatoma and adrenocortical carcinoma. Four are alive with disease at a median of 17 months and seven are dead of disease at a median of 11 months after the first RF ablation. One of these last patients went to Michigan for cryoablation which was much less painful than RF ablation.

Musculoskeletal RFA has been very helpful in adults with painful metastases and is competing with radiotherapy for palliation because the pain relief is immediate. I have performed RFA on five pediatric patients with good success in truncal lesions (rhabdomyosarcoma of breast, leiomyosarcoma of ribs). However the head/neck and extremity lesions are far away from the grounding pads and the high impedance inhibits effective ablation. Perhaps bipolar RF, cryotherapy, microwave, or high intensity focused ultrasound (HIFU) will be more useful in these lesions since they do not require ground pads.

Both cryotherapy and RF ablation have been performed in adults with peripheral renal cell carcinoma [18]. I am hoping that thermal ablation can be used to treat malignant lesions after nephron sparing surgery of nephroblastomatisosis and Wilms tumor [19].

Thrombolysis and venous angioplasty is useful to restore central venous patency and may be required in pediatric oncology patients who are hypercoagulable from chemotherapy or who have had subclavian venous access. Central venous line placement by imaging guided internal jugular access has the least thrombosis/stenosis rate [20].

Pleurodesis for malignant pleural effusions at the end of life may allow patients to return home without a chest tube [unpublished]. After percutaneous chest tube placement, Doxycycline can be placed in and within 30 minutes removed from the pleural space under general anesthesia with sclerosis of the pleura occurring within 24 hours.

References


