Metastatic Carcinoma to Bone

One of the major complications of carcinoma in the adult human being is its potential to metastasize to bone. The incidence of metastatic carcinoma to bone is fifteen times greater than the incidence of primary sarcomas of all types. This amounts to approximately 300,000 new cases each year. It has been stated that about 70 per cent of all patients who die of advanced carcinoma will demonstrate evidence of metastatic lesions in bone at time of autopsy. The two most common metastatic tumors that go to bone are breast in females and prostate in males, followed next by kidney, thyroid and lung. Carcinomas that are least likely to go to bone include skin cancers, oral carcinomas, esophageal, cervical, stomach and colon carcinomas. The spine is by far the most common site for metastatic disease, followed next by the pelvis, femur, ribs, proximal humerus and skull. It is very unusual to find metastatic lesions distal to the knee or elbow but, if they are found there, the most common etiology would be lung carcinoma. Only nine per cent of metastatic lesions to bone will be solitary in nature.

Breast cancer is by far the most common cause for metastatic disease to bone in females, accounting for about 50 per cent of all metastatic carcinomas. Radiographically, the lesions appear as a primary lytic focal destruction within the bone, frequently associated with a ring of reactive bone at the periphery of the lytic process, giving a mixed lytic and blastic appearance. Generally, the more lytic the process is, the more likely a pathological fracture and a worse prognosis. Likewise, with therapeutic approaches including hormones, chemotherapy and radiation therapy, the lytic component will decrease in volume and the blastic component will increase. This decreases the chance for fracture and decreases pain symptoms. With prostate carcinoma, lesions are usually more blastic in nature and pain is not a problem, and the incidence of pathological fracture is also reduced. However, not all prostate metastases are blastic in nature. In the case of lytic prostate carcinoma metastases, patients have more pain, the incidence of pathological fracture is greater, and the prognosis is worse.

Many carcinomas induce a hyperemic response in the surrounding host tissue, creating an aneurysmal appearance on radiographic examination. This is the case with many renal cell carcinomas and thyroid carcinomas, as well as multiple myelomas. Much of the hemorrhagic lytic destruction of bone is the result of the tumor cell activating osteoclastic destruction in the surrounding bone, similar to what occurs in hyperparathyroidism, and thus a significant medical treatment for this lytic process is to inhibit the osteoclastic activity by use of

bisphosphonate therapy, specifically Aredia, which is given intravenously on a monthly basis during the active phase of the disease. Mechanically speaking, it is sometimes advisable to use prophylactic embolization therapy to the hyperemic lesions prior to any surgical procedures, especially with lesions that have not been previously irradiated. This will markedly reduce the chance of excessive hemorrhage at the time of surgical reconstruction.

The staging process designed to discover the primary source of the metastatic lesion to bone should include a routine CT scan of the chest and abdomen, looking for primaries in the lung, abdominal viscera, along with a total skeletal bone isotope survey to look for multifocal disease that frequently is characteristic for metastatic carcinoma. Routine radiographs are notorious for not picking up early medullary lesions with spinal metastases, whereas a bone isotope scan is very sensitive for lesions in the spine. Likewise, lesions in the ribcage are difficult to pick up on routine radiographs.

The prognosis for survival following a pathological fracture through a metastatic lesion is variable with the best prognosis seen in prostate carcinoma, with an average survival of about three years. Next would be breast carcinoma with an average survival of about two years. Renal cell carcinoma averages a one-year survival and the lung has the worst prognosis of all with only a six-month survival.

A common non-surgical treatment is irradiation to the metastatic area. Local radiation therapy gives the best clinical response in prostate carcinoma, an intermediate response with breast cancer, and the worst response with renal and gastrointestinal carcinomas. Hormonal therapy is a common adjuvant treatment for prostate and breast cancer. Tamoxifen is a common anti-estrogen agent used for the treatment of breast carcinoma; it is effective in 30 per cent of cases. Cytotoxic chemotherapy is now commonly used for metastatic carcinoma, especially in the middle-age group that can tolerate this aggressive systemic therapeutic protocol.

Surgical treatment for metastatic cancer to bone can be used in more advanced cases that do not respond to medical or radiation therapy. It usually consists of either a prophylactic metallic fixation, with or without methyl methacrylate, or open reduction, internal fixation of a fracture at the time of admission following an acute pathological fracture. One of the most common areas for a pathological fracture is in the hip where bipolar or total hip prostheses can be implanted with methyl methacrylate, which allows for immediate weight bearing. The patients

will usually undergo radiation therapy postoperatively and therefore porous ingrowth devices should not be used. The femoral shaft is another very common area for pathological fracture and interlocking intramedullary devices work well. If there is a large lytic defect, these devices should also be augmented with methyl methacrylate to avoid problems with subsidence and breakdown of the interlocking system.

If spinal metastases are picked up early, radiation therapy will usually reduce the pain and prevent spinal cord compression. However, if the disease progresses and the cord is compromised, surgical intervention is indicated. Posterior laminectomy decompression is not advisable because of further kyphotic collapse with the destabilizing effect of posterior element resection. Most spinal lesions are best approached anteriorly where stabilization is done using methyl methacrylate, allograft or metallic devices such as cages or anterior buttress plates. A recent approach to this problem is by means of a percutaneous technology with a vertebroplasty injection of methyl methacrylate into the vertebral body tumor site. This can be used prophylactically to avoid compression fracture or, in some cases, to restore height after a compression fracture occurs.