# Pot-Bellied Vietnamese Pig with Visceral Mast Cell Tumor and Mastocytemia

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**Abstract**

An approximately 12-year-old, female Vietnamese Pot-Bellied Pig presented to the Mississippi State College of Veterinary Medicine for anorexia of two days duration. On physical examination, the patient appeared depressed, lethargic and had significantly pale mucus membranes, open mouth breathing and nostril flaring. Abdominal palpation was tense and uncomfortable. A CBC and chemistry profile were performed. The CBC revealed a significant anemia and mild leukocytosis characterized by a mild neutrophilia with a regenerative left shift. Mast cells were rarely observed. Hematocrit = 8.1% (RI 22-50), RBC = 1.25 x $10^6$/ul (RI 3.6-7.8), WBC = 19.85 $10^3$/ul (RI 5.2-17.9), Neutrophils = 15.08 x $10^3$ (RI 0-11.4), Bands = 0.993 x $10^3$ (RI 0-0.019). The chemistry profile was unremarkable with a mildly elevated BUN and slightly decreased total protein and albumin. BUN = 39 mg/dl (RI 4.2-15.1 mg/dl), Total Protein = 6.2 g/dl (RI 6.6-8.9) and Albumin = 2.5 (3.6-5.0 g/dL)

An abdominal ultrasound revealed numerous, hypoechoic nodules diffusely scattered throughout the hepatic parenchyma. An FNA was performed. A mild suppurative component and numerous variably granulated mast cells were observed. A presumptive cytological diagnosis of mast cell tumor was made. Histopathology was performed which confirmed the cytological interpretation

**Keywords**

Cytology, porcine, mast cell tumor, visceral

## Case Presentation

An approximately 12-year-old, female Vietnamese Pot-Bellied Pig presented to the Mississippi State College of Veterinary Medicine (MSU-CVM) Food Animal Service on August 31, 2020 for lethargy and anorexia of two days duration. The patient arrived after a three-hour trailer ride. On physical examination, she appeared in moderate distress with open mouth breathing. Mucous membranes were notably pale. Her pulse, and respiratory rate were moderately elevated. Pulse = 148 bpm (reference interval [RI] 70-110) and her respiratory rate = 60 (RI 20-30). Dumplin had evidence of being slightly dehydrated. Her heart and lungs auscultated normally. No other gross abnormalities were noted. A CBC and chemistry profile were performed.

The CBC revealed a significant anemia and mild leukocytosis characterized by a mild neutrophilia with a regenerative left shift which is compatible with an inflammatory leukogram. Mast cells were rarely observed (Figure 1). Hematocrit = 8.1% (RI 22-50), RBC = 1.25 x $10^6$/ul (RI 3.6-7.8), WBC = 19.85 $10^3$/ul (RI 5.2-17.9), Neutrophils = 15.08 x $10^3$ (RI 0-11.4), Bands = 0.993 x $10^3$ (RI 0-0.019). The chemistry profile was unremarkable with a mildly elevated BUN and slightly decreased total protein and albumin. BUN = 39 mg/dl (RI 4.2-15.1 mg/dl), Total Protein = 6.2 g/dl (RI 6.6-8.9) and Albumin = 2.5 (3.6-5.0 g/dL). The mildly elevated BUN may be the result of dehydration. Considering that albumin decreases during inflammation (negatively acute phase reactant), the hypoproteinemia/hypoalbuminemia may be the result of the ongoing inflammation. Porcine reference ranges at our institution are not established for specific porcine breeds such as the Pot-Bellied Vietnamese Pig, therefore the reference intervals used above were cited from an original article by C.W. Brockus and colleagues.[1]

An abdominal ultrasound revealed numerous, hypoechoic nodules diffusely scattered throughout the hepatic parenchyma. An FNA was performed. The sample was increased in cellularity and

had a significant amount of blood contamination. A mixed population of inflammatory cells were observed that consists of neutrophils, macrophages, small lymphocytes and eosinophils. The neutrophils appeared moderately increased whereas the other inflammatory cells appeared relatively proportional to the blood contamination. A suppurative component was suspected. However, considering that the patient has a peripheral neutrophilia, the increased number of neutrophils could be the result of peripheral blood contamination. Clusters of hepatocytes were observed in moderate numbers. They appear relatively normal. Scattered throughout the preparations are numerous, variably granulated mast cells (Figures 2 & 3). A cytological diagnosis of mast cell tumor was made. Considering how rare mast tumors are in the porcine species, a biopsy was recommended to confirm the cytological interpretation.

Chest radiographs were negative for evidence of metastasis. A blood transfusion was recommended but a compatible donor could not be found. Due to the poor prognosis and lack of a compatible blood donor, the owners opted for humane euthanasia.

Significant necropsy findings include pale mucus membranes of the vulva and oral cavity and a few multifocal petechial to ecchymotic hemorrhages present on the skin of the ventrum. The abdominal cavity contains 1-2 L of red tinged fluid. There is gelatinous red material adhering the liver lobes to the abdominal wall. It appears meaty on cut surface. The liver has multifocal white to tan raised nodules throughout all lobes, the largest measuring 3.7 x 3 x 2.3 cm. On cut surface, these nodules extend into the parenchyma, bulge on cut surface and are tan and homogenous. Similar smaller masses are found transmurally throughout the intestines. The gastric lymph node is enlarged and has the same consistency as the masses. The adrenal glands have raised pinpoint nodules at the border of the medulla and cortex (nodular hyperplasia). Bilaterally the parenchyma of the kidneys have numerous small cysts. The spleen is

purple and enlarged. There are two large masses found within the wall of the uterus, the largest, which is found in the body, measures 6.5 x 6 x 3 cm. This mass has a thick outer rim with chalky material in the center on cut surface. There is another pendulous mass associated with the left uterine horn measuring 3.5 x 3 x 2 cm. This mass is firm and has a red center on cut surface. There are rare multifocal fibrous adhesions from the lungs to the thoracic cavity, between lung lobes, and between lung lobes and the pericardium. These are associated with multifocal similar masses as seen within the liver, with the largest being 1.2 x 1.2 x 0.3 cm. There is a small amount of red tinged foamy fluid in the trachea.

Histopathology of the liver revealed several variably sized, unencapsulated, well demarcated, compressive nodules composed of a densely cellular round cell neoplasm that disrupt the normal liver parenchyma. Neoplastic cells are arranged in densely packed sheets interspersed with moderate numbers of eosinophils within a minimal fibrovascular stroma. Neoplastic cells resemble mast cells and are distinct, with scant amounts of eosinophilic cytoplasm that contain variable amounts of fine, amphophilic granules (Figures 4 & 5). Neoplastic nuclei are centrally located, large and have finely stippled chromatin and one to two indistinct nucleoli. There is moderate anisocytosis and anisokaryosis. Mitotic rate is high and averages 4-5 per high powered fields with occasional bizarre mitotic figures. Scattered throughout are frequent apoptotic cells as well as islands of amorphous eosinophilic debris admixed with hemorrhage. Sinusoids frequently contain large numbers of neoplastic cells and eosinophils as well as macrophage with brown hemosiderin pigment. Neoplastic cells stain variably with the CD117 immunohistochemical stain (Figure 6) and negative for CD3, and CD79. The neoplastic cells did not stain positive with Toluidine Blue or Giemsa. These stains should highlight the granules but did not. We did not have a plausible explanation, but it has

been documented in pigs that Carnoy's fluid is a good fixative but fixation with neutral buffered formalin blocked staining of most mast cells.[2] Within the remaining liver, there are increased numbers of binucleate hepatocytes which display mild anisokaryosis and anisocytosis. Frequently hepatocytes contain brown hazy cytoplasmic pigment (lipofuscin). Periportal stroma is expanded by increased numbers of bile duct profiles and moderate numbers of lymphocytes, plasma cells and eosinophils. Mast cell tumors were also found within the lung, spleen and adrenal gland. Several abdominal lymph nodes are completely effaced. Multifocally, the small intestinal wall is expanded by well demarcated foci of neoplastic mast cells. No neoplastic changes were seen within the bone marrow which rules out a mastocytic leukemia. No cutaneous nodules were appreciated in this case and the tumor appeared to be entirely visceral. The multiple masses in the uterus are consistent with leiomyomas, which are a benign smooth muscle tumor frequently occurring in the reproductive tract of pigs. Although leiomyomas may rarely cause clinical disease (usually as a result of obstruction) they are most often, as in this case, incidental findings and were likely unrelated to the mast cell tumors seen within the other organs.

**Discussion:**

Mast cell tumors have been reported in pigs 6 months to 3 years of age and there are no breed or sex predilections.[3] Other literature supports the mean age of pot-bellied pigs with neoplasia was determined to be 11.3 years, confirming that it is often a disease of geriatric animals.[4] Hepatic and intestinal carcinomas have been documented to be the predominating malignancies found in Pot-bellied pigs.[4] In domestic animals, mastocytomas (mast-cell tumors) are found most frequently in dogs, less frequently in cats and cattle, and rarely in horses and pigs[5]. There are few reports describing mast cell proliferation in pigs, and the majority refer to systemic mastocytosis with associated cutaneous tumors: more rarely, spontaneous neoplastic proliferations confined to

the skin have been reported.[6] However, porcine mast cell leukemia with systemic mastocytosis has been described that did not involve cutaneous or dermal involvement.[7] Our case is unique for multiple reasons. The patient had no dermal/cutaneous mast cell lesions, like most cases do. Nor did the patient have mast cell leukemia which has been documented to not involve the skin.[7] To the author's knowledge this is the first documented case of visceral mast cell neoplasia with mild mastocytemia in the porcine species.

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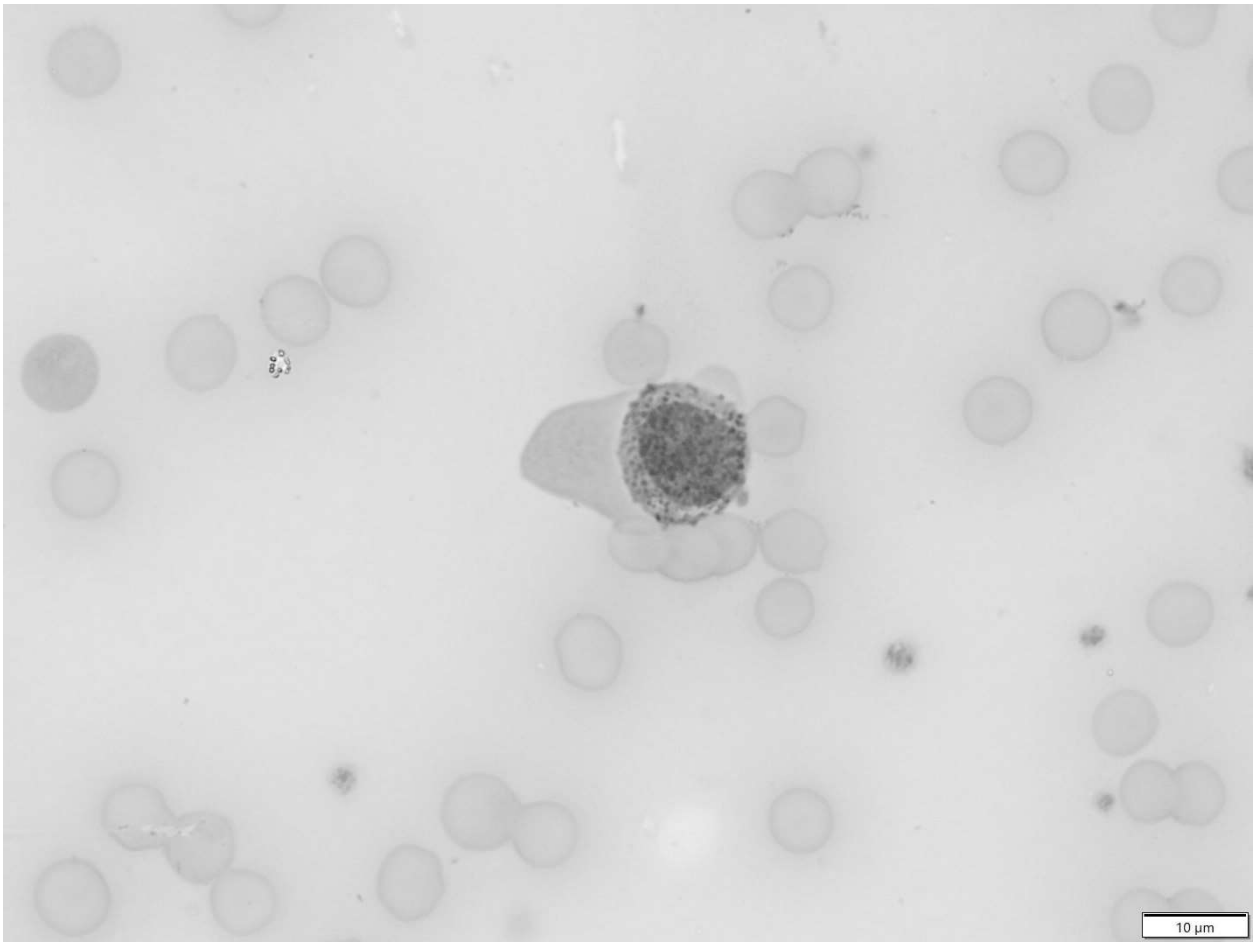
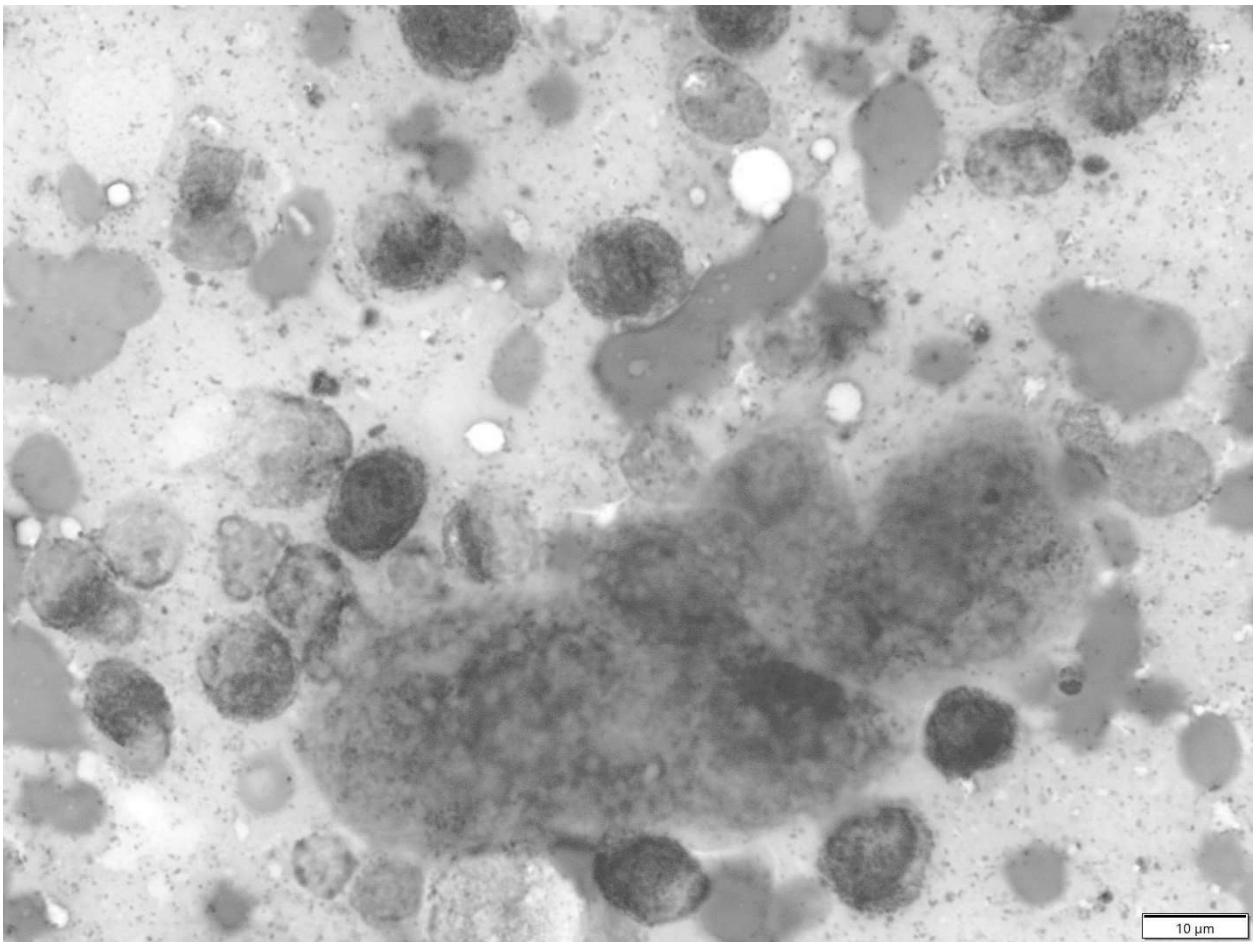
Figure 1. Circulating mast cells in the peripheral blood (X100 magnification)



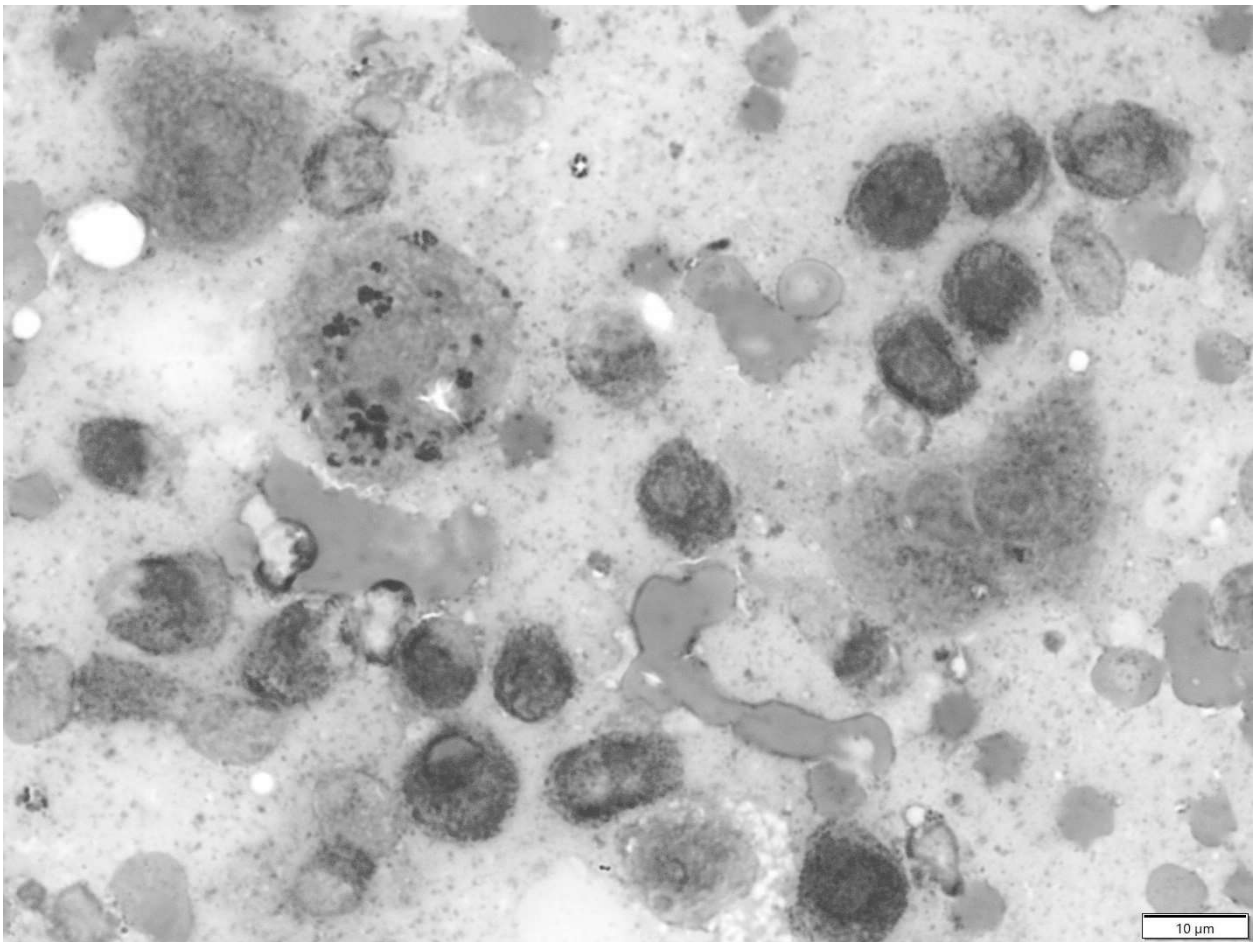

*(By: Dr. Matthew Williams)*

Figure 2. Variably granulated mast cells surrounding a cluster of hepatocytes (X100 magnification)




*(By: Dr. Matthew Williams)*

Figure 3. Mast cells and hepatocytes. One of the hepatocytes contains significant amounts of lipofuschin (X100 magnification)




*(By: Dr. Matthew Williams)*

Figure 4 – Well demarcated, non-encapsulated hepatic nodule composed of neoplastic mast cells (X40 magnification)

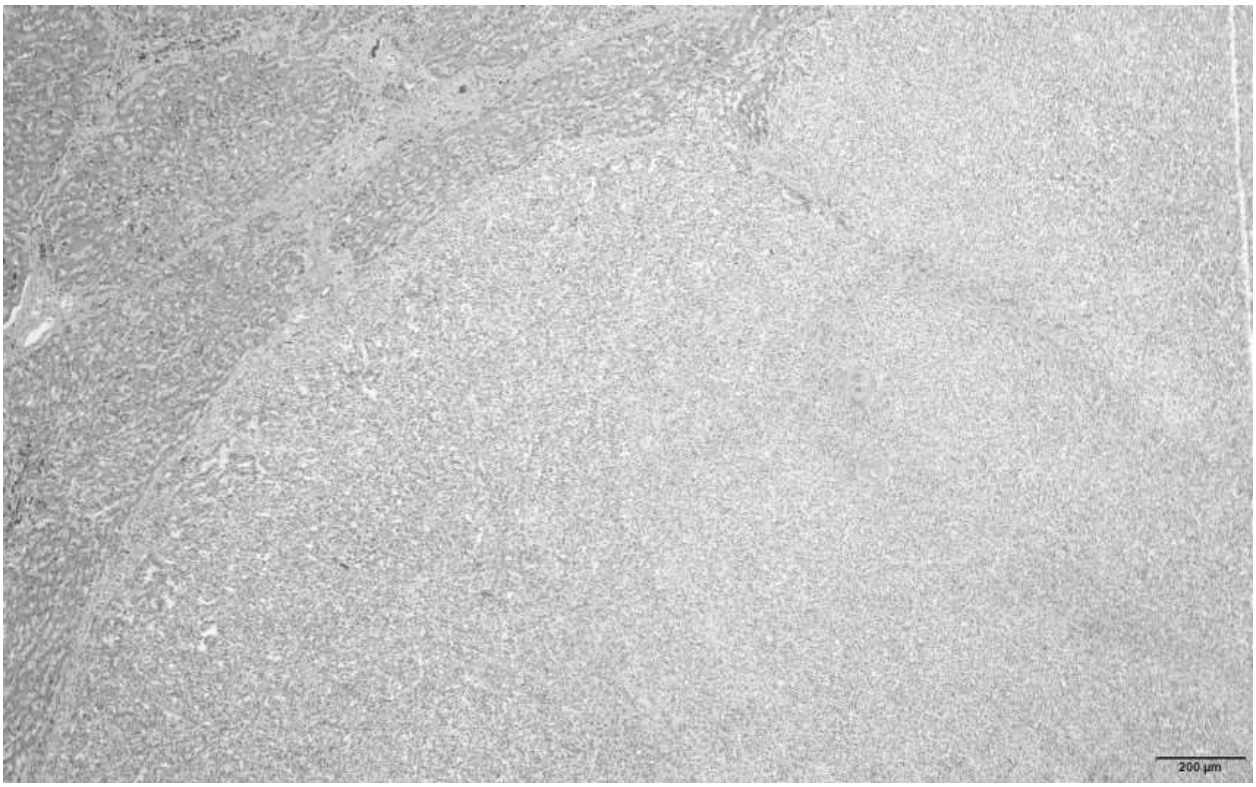



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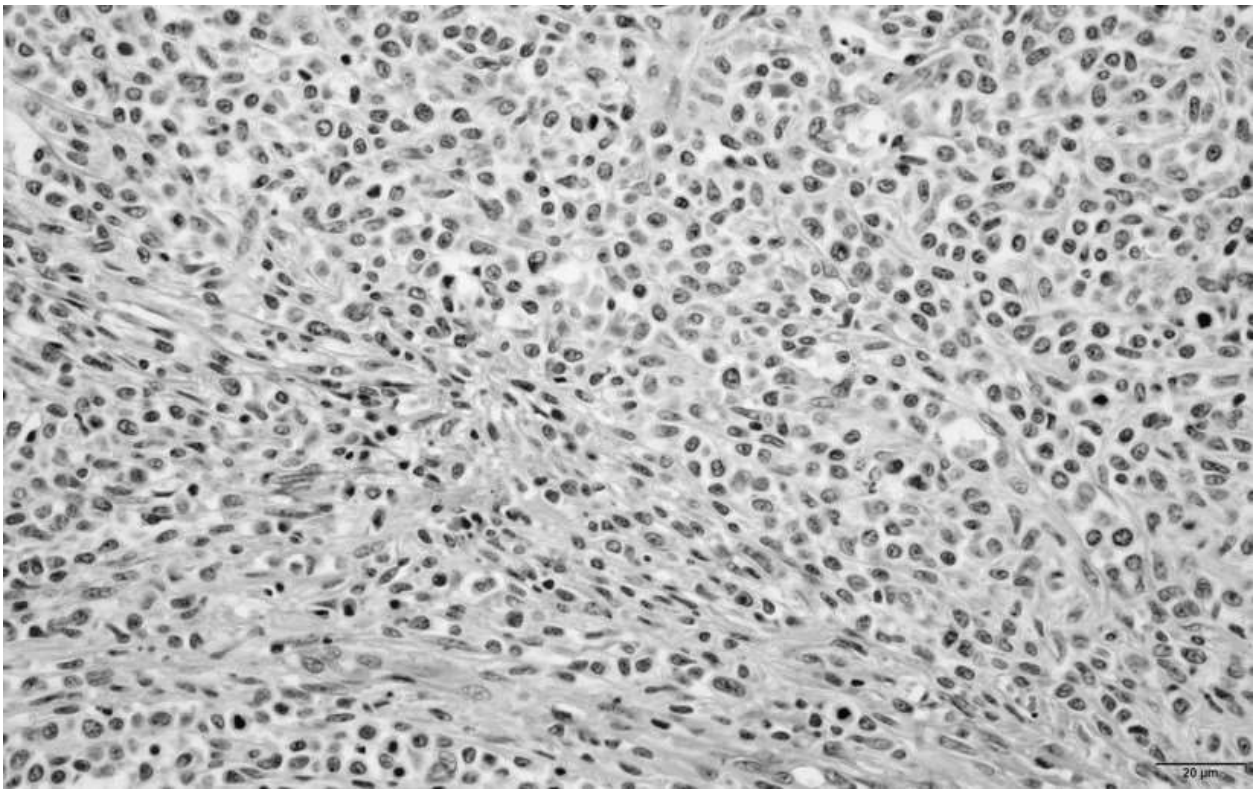
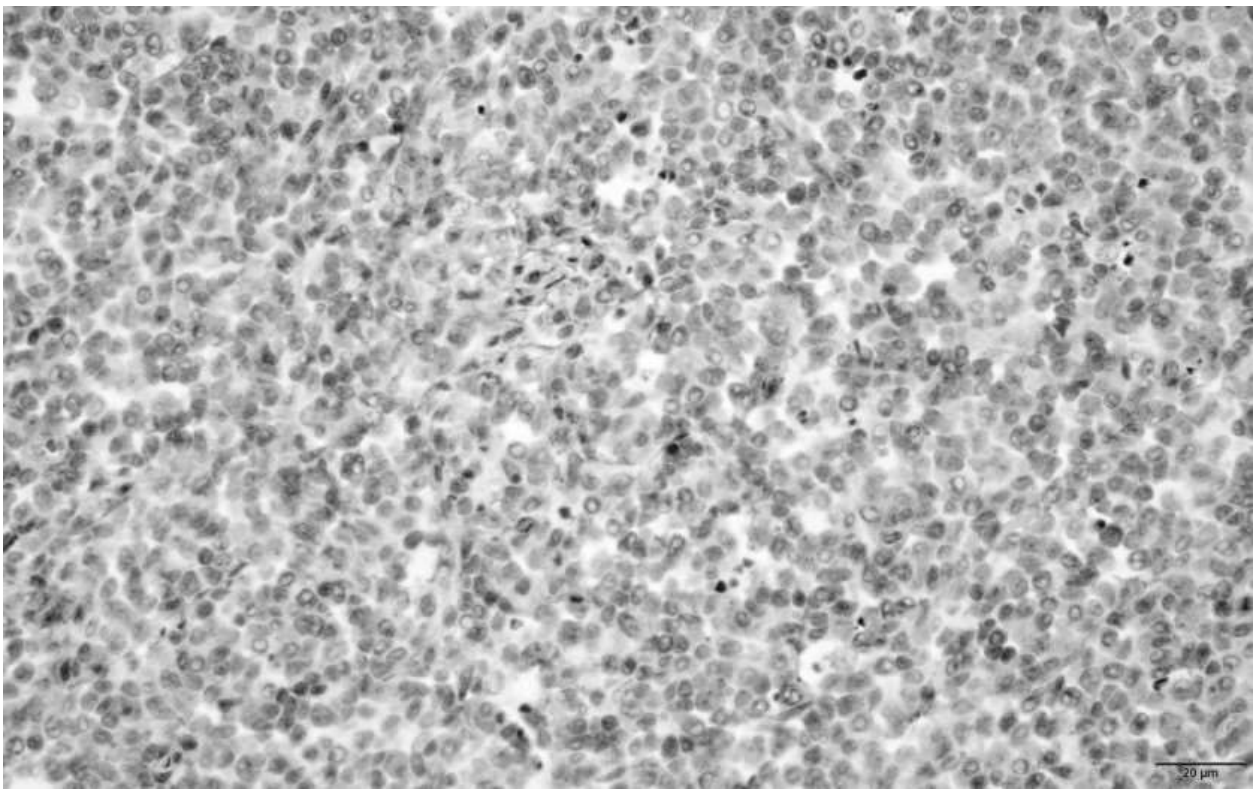
Figure 5 – Neoplastic mast cells with fibrovascular stroma (X40 magnification)




*(By: Dr. Matthew Williams)*

Figure 6 – CD 117 immunohistochemical stain (X40 magnification)




*(By: Dr. Matthew Williams)*