

CASE REPORT

Embryonal Rhabdomyosarcoma in a Young Boy

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INTRODUCTION

Soft tissue tumours are classified according to the tissue they appear as: such as muscle, fat, fibrous tissue, vessels and nerves. Rhabdomyosarcoma is the most common soft tissue sarcoma of childhood and adolescence, and is a skeletal muscle tumour. It occurs in any anatomic location, although mostly in the head, neck or genitourinary tract where there is normally relatively little skeletal muscle involved (1). Skeletal muscle is only involved in the body extremities (2). Rhabdomyosarcoma is malignant; in contrast, the benign variant, rhabdomyoma, is very rare. Rhabdomyosarcoma tends to present as an expanding mass, resulting in pain and symptoms related to the compression of nearby structures. Metastases can lead to pain in the bones, difficulty with respiration due to lung nodules or pleural effusion, anemia, thrombocytopenia, and neutropenia, with 5-year survival rate less than 30% (3). In contrast, confined disease treated with combined surgery, radiation and chemotherapy has a 5-year survival rate of over 80% (3). The incidence of rhabdomyosarcoma is 6 cases per 100,000 per year in the United States, and approximately 87% of patients are under 15 years of age (3). It is valuable for medical students to understand an example of a clinical case of pediatric embryonal rhabdomyosarcoma. An awareness of the typical investigations and the general prognosis in a case of pediatric embryonal rhabdomyosarcoma allows medical students to consider this type of tumour in their differential diagnoses, when appropriate.

THE CASE

The father of 9-year-old Bobby from London, Ontario took his son to the emergency department at Victoria Hospital. Bobby had a 5-day history of right neck

swelling and tenderness, and dysphagia, a sensation of food sticking in his throat. No other physical findings of interest were noted. His temperature was not elevated and he was not short of breath.

Among the differential diagnoses the emergency physician considered based on her physical exam were benign and malignant neoplasms, inflammatory disease, vascular tumours, Burkitt lymphoma, Ewing's sarcoma, and neuroblastoma, as well as rhabdomyosarcoma (3, 4). The initial approach to diagnosis included imaging to localize the disease, followed by open neck biopsy for tissue diagnosis.

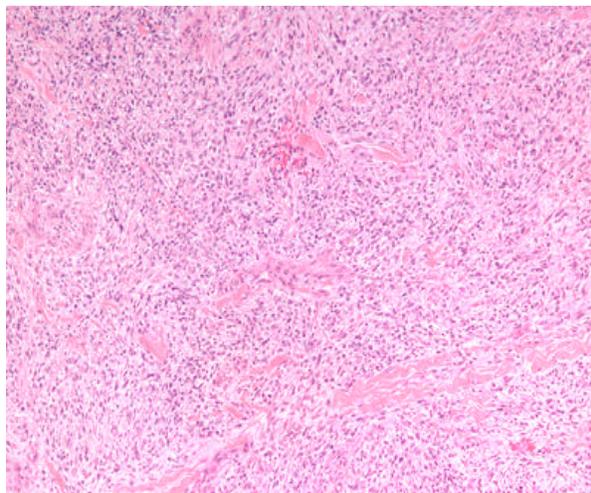


Figure 1. The cells demonstrated a typical small round blue cell tumour phenotype. Mitotic activity, mitotic figures, and prominent nucleoli were noted. Upon close inspection, tadpole-shaped and tennis-racquet shaped cells can be observed, resembling primitive skeletal muscle (10).

A T1 MRI was obtained to determine the radiological features of Bobby's neck area, showing an obvious large mass in the right anterior lateral neck. A week later, an open neck biopsy was performed. Histologically, the highly cellular samples showed spindle shaped cells. On high magnification,

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hyperchromatic irregular nuclei were readily visible. The cells demonstrated a typical small round blue cell tumour phenotype (See Figure 5). Mitotic activity, mitotic figures, and prominent nucleoli were noted. Upon inspection, tadpole-shaped and tennis-racquet shaped cells resembling primitive skeletal muscle were noted. These histological features, along with the patient's young age and the location of the neck mass resulted in the final diagnosis of rhabdomyosarcoma. Several histochemical stains were key in arriving at this conclusion (5).

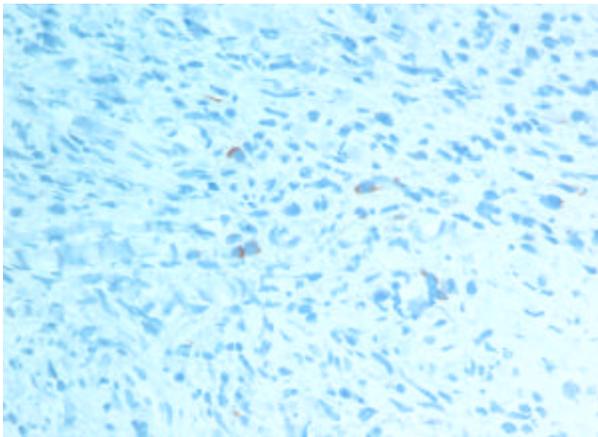


Figure 2 A Desmin stain was positive, indicating the presence of muscle cells (10).

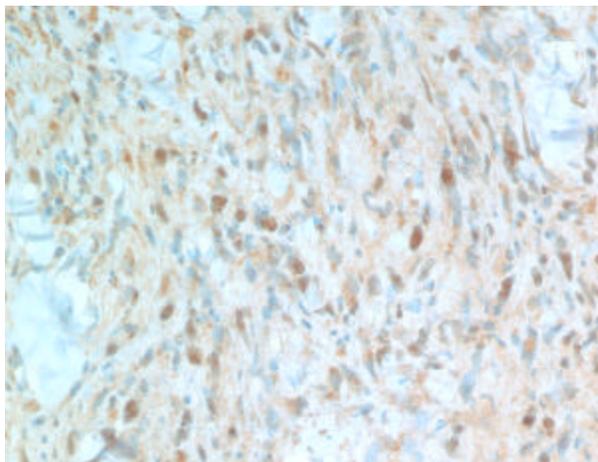


Figure 3 A MyoD1 stain, an immunohistochemical stain, was also performed. This is a primitive transcription factor that regulates Desmin production, and the stain confirmed the muscle origin of the tumour and its primitive characteristics (10).

Further special stains were performed for confirmation, classification and to determine prognostic information. In Bobby's case, a Desmin stain was positive, indicating the presence of muscle cells (See Figure 9). Desmin is an intermediate filament protein present in smooth muscle cells, striated muscle cells and myocardium. A MyoD1 stain, an immunohistochemical

stain, was also performed, and found to be positive (See Figure 10). MyoD1 is a primitive transcription factor that regulates Desmin production, and confirmed the muscle origin of the tumour and its primitive characteristics. A PAS stain was performed, which was pink to indicate the presence of glycogen and/or mucin (See Figure 7). A further PASD stain was performed, in which the diastase enzyme would ingest glycogen. This test indicated the presence of glycogen (See Figure 8). Finally, a Reticalin stain was performed, which showed a distinct pattern of cellularity typical in embryonal rhabdomyosarcoma (See Figure 6) (5).

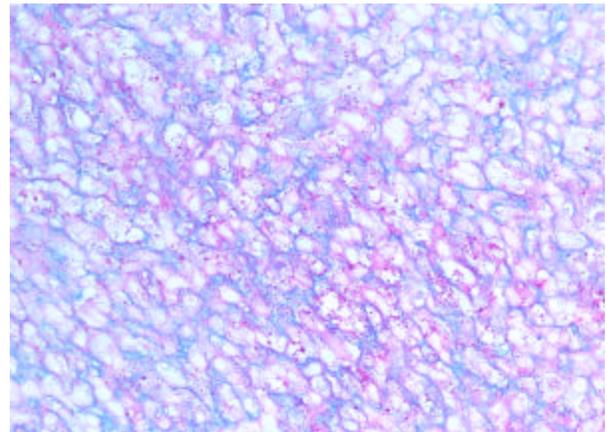


Figure 4. A PAS stain was performed, which was pink to indicate the presence of glycogen and/or mucin (10).

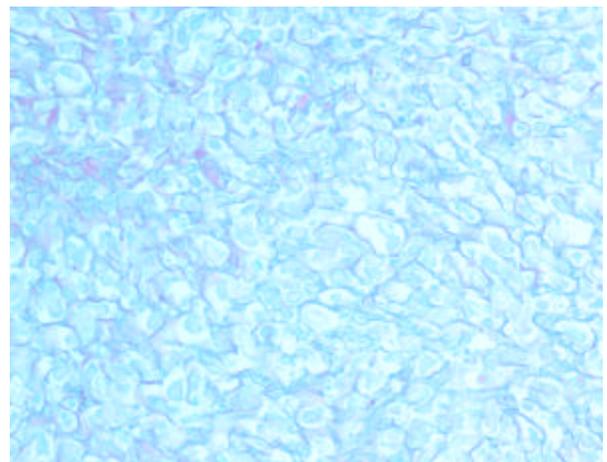


Figure 5. A further PASD stain was performed, in which the diastase enzyme would ingest glycogen. This test indicated the presence of glycogen (10).

Thus, histopathological analysis confirmed that the tumour was embryonal rhabdomyosarcoma. This type of rhabdomyosarcoma is the most common, and it is typically composed of elongated pleomorphic tumour cells with a centrally located hyperchromatic nucleus surrounded by a significant amount of eosinophilic cytoplasm. These tumours include primitive mesenchymal cells with varying stages of

morphological skeletal muscle differentiation, such as strap cells and striated cytoplasm, in a loose, myxoid or cellular collagenous stroma. There can be nuclear pleomorphism (6).

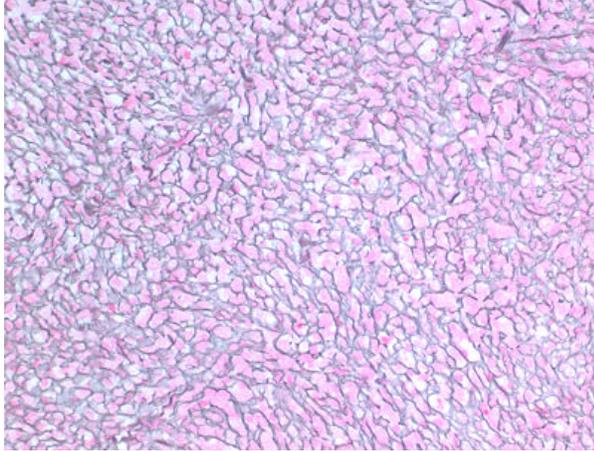


Figure 6 A Reticulin stain was performed, which showed a distinct pattern of cellularity typical in embryonal rhabdomyosarcoma (10).

On histologic examination, embryonal rhabdomyosarcoma cells have high cytologic variability, representing several stages of skeletal muscle morphogenesis. They can appear to be highly differentiated neoplasms containing rhabdomyoblasts with large amounts of eosinophilic cytoplasm and cross striations, but more commonly appear as poorly differentiated tumor cells than as highly differentiated cells. They also have particular molecular characteristics. Embryonal rhabdomyosarcoma cells show a consistent loss of the material from the 11p15 region (the short arm of chromosome 11), and also have a lack of gene amplification. In addition, the cellular DNA content of embryonal rhabdomyosarcoma is hyperdiploid, with approximately 1.1-1.8 times the normal DNA (7).

DISCUSSION

Since the tumour was in the neck, local to an area of numerous delicate structures, the tumour compressed Bobby's esophagus, thereby causing his swallowing difficulties and leading to the sensation of food sticking in his throat (See Figures 1, 2, 3 and 4).

The identification of rhabdomyosarcoma and its subtypes is important because alveolar rhabdomyosarcoma has been reported to have a poor prognosis and to be associated with a greater frequency of disseminated metastases. The diagnosis of most pediatric solid tumours requires extensive immunohistochemical markers because they often exhibit a nonspecific small round cell tumour phenotype (6). There are 3 commonly used staging systems for rhabdomyosarcoma: clinical

(surgicopathologic), TNM, and IRS (Intergroup Rhabdomyosarcoma Study) staging (4). IRS clinical grouping is particularly useful because previous studies have indicated comparatively favourable and unfavourable prognostic groups. The IRS classification includes four groups, based on tumour respectability (7). Group 1 includes localized disease, completely resected. Group 2 includes total gross resection with evidence of regional spread. Group 3 includes incomplete resection with gross residual disease. Finally, Group 4 includes distant metastatic disease present at onset.

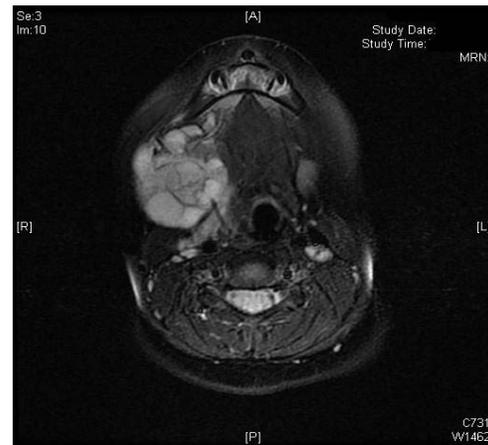


Figure 7. The MRI shows a large, well-defined lobulated solid mass lesion located in the right masticator space deep to the angle of the right mandible (10).



Figure 8. The MRI shows that the mass is approximately 5.2 x 4.3 cm (AP x transverse), centered in the right half of the face/neck (10).

While most cases of pediatric rhabdomyosarcoma are sporadic, risk factors include: neurofibromatosis, Li-Fraumeni syndrome, Costello syndrome, Noonan syndrome, Beckwith-Wiedemann syndrome, and parental use of cocaine or marijuana. One-third of pediatric rhabdomyosarcoma cases occur in the head and neck region, and 90% of all cases occur in patients

less than 25 years of age. In addition, males are affected 1.5 times more often than females. The five embryological subtypes of rhabdomyosarcoma include: embryonal, alveolar, botryoid, spindle cell, and anaplastic (4). Approximately 60% of all newly diagnosed rhabdomyosarcomas are of embryonal type, and usually happen in younger children (1, 8).

With combined modality therapy - chemotherapy, radiation therapy, and surgery - the overall survival rate for all pediatric rhabdomyosarcomas is 71% (8). Younger patients tend to have a more favourable prognosis, for unknown reasons (9). Multimodality treatment is typically recommended for cases of pediatric rhabdomyosarcoma. In cases of pediatric rhabdomyosarcoma, the need for surgery depends on the anatomical site of the tumour. Bobby was sent for an oncology consult, and received chemotherapy (Vincristin, Dactinomycin with Cyclophosphamide) followed by adjuvant radiation therapy. At follow-up, Bobby was recovering well.



Figure 9. The MRI shows smaller, cystic regions scattered in the mass lesion. It extends medially to affect the right pharyngeal mucosal space, with notable effacement of the oropharynx (10).

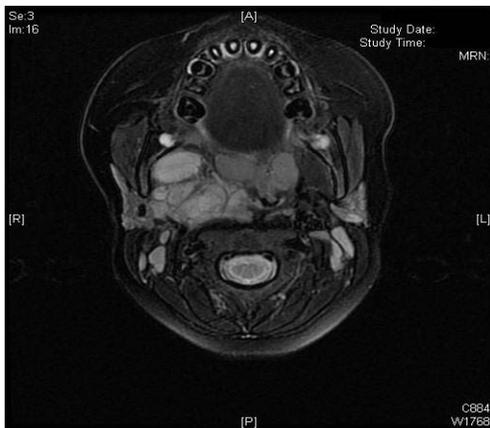


Figure 10. The MRI shows that the adjacent right mandibular body and angle show good cortical outline. There is no definite cortical destruction indicated (10).

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