INTRODUCTION

Orbital rhabdomyosarcoma has come to be recognized with such increasing frequency in recent years that over 225 patients have been described in the literature. Most of these have been recorded since 1960, based on a review of examples seen in clinical practice\(^2\) or in pathology laboratories.\(^2,3\) Calhoun and Reese\(^4\) first recognized the importance of rhabdomyosarcoma and emphasized the criteria for its clinical and histologic diagnosis. They pointed out such striking histologic features as pronounced polymorphism of the tumor cells, the presence of spindle cells tinctorially resembling muscle cells, the presence of giant cells, and the existence of cytoplasmic fibrils that are frequently but not always cross-striated.

Attempts have been made to classify rhabdomyosarcoma histologically with the hope that information might be provided as to the prognosis for survival in patients with these tumors.

Porterfield and Zimmerman\(^2\) utilized the classification made by previous observers, subdividing these tumors into embryonal and alveolar types, and added a third type, the differentiated form. Cross-striations were found in 60 per cent of the embryonal (40 tumors), 100 per cent of the differentiated (6 tumors), and 33 per cent of the alveolar types. Ashton and Morgan\(^3\) subsequently studied 34 cases of orbital rhabdomyosarcoma, subdividing them into embryonal completely undifferentiated without cross-striations (10 tumors), embryonal with rhabdomyoblasts but without cross-striations (6 tumors), and 18 examples of embryonal rhabdomyosarcoma with cross-striations. Somewhat less
than 50 per cent of the tumors described by Ashton and Morgan and
close to 60 per cent of those described by Porterfield and Zimmerman
showed cross-striations, one of the criteria used to establish the histologic
diagnosis of these tumors. Jones et al. subsequently reported 62 ex-
amples from their own files. Two-thirds were embryonal, 12 per cent
were alveolar, and the remainder were pleomorphic. No figures were
given on the presence of cross-striations, but because of the time in-
volved in the search the authors commented on the unrealistic require-
ment of identification of cross-striations for histologic diagnosis of these
tumors. The practical value of a structural classification of rhabdomyo-
sarcoma is questionable because individual tumors may exhibit several
arrangements and types of cell. Also the primary tumor may show no
cross-striations and the metastases may reveal well developed striations,
and vice versa. In three of nine tumors described by Porterfield and
Zimmerman cross-striations were found in the metastases but not in the
orbital tumor. The prognosis in these tumors seems to be related more
to site of origin, early recognition, and prompt surgical intervention than
to cell type and pattern.

Rhabdomyosarcoma is an uncommon tumor. Jones et al. found rhab-
domyosarcoma to comprise 3 per cent of the total number of orbital
tumors in their collection. It has become evident that rhabdomyosarcoma
is the commonest primary malignant tumor of the orbit in childhood and
that the orbit is the most frequent site for this tumor. The average age
at onset is approximately eight years in most of the reported studies.
Table 1 shows the frequency in different childhood age groups.

There is a slight preponderance of these tumors in males and each
orbit is as frequently affected. The site of presentation in the orbit varies
in different series. Frayer and Enterline found down-and-out displace-
ment of the eye in 8 of 12 patients, up-and-out in 1 patient, none in 2,
and undetermined in 1. Porterfield and Zimmerman found eye displace-
ment downward and temporally in 18 of 19 patients in which the dis-
placement was indicated in their series of 55 patients. Jones et al. found
50 per cent of tumors to be central, 12 per cent below, 6 per cent nasal,
6 per cent temporal, and 25 per cent above the eye. Ashton and Morgan
found no special tendency for the upper nasal orbit to be involved.

The symptoms of these tumors evolve rapidly and are characterized
by proptosis that is frequently associated with lid invasion by the tumor,
pain, headache, and tearing. If the tumor arises in the ethmoid region,
invasion of the nose leads to nosebleed. On examination the eye is almost
always displaced forward and in one or another direction away from the
primary position, movement is restricted, and there may be ecchymosis,
chemosis, and lid edema. A tumor can be palpated if the lesion has extended forward, and frequently there is resistance to back pressure on the eye. Papilledema most often occurs if the tumor is located in the central orbit.

The diagnosis is made on the basis of age, rapidity of progression, clinical findings, and x-ray evidence of an enlarged orbit and possible bony erosion. The differential diagnosis includes hemangioma, neuroblastoma, and leukemia. The latter two can be diagnosed by the presence of tumor or disease elsewhere and their more torpid course. Hemangioma is usually regressing at the time most of the rhabdomyosarcomas appear, and even in younger age groups it does not have a rapidly progressive course.

Because of inexperience and a low index of suspicion the diagnosis and treatment may be delayed past the period when extension and metastasis have occurred. Early radical therapy is important for control of this tumor. Roentgen therapy and chemotherapeutic agents are advocated by some, and exenteration followed by radiation therapy by others. Fifty per cent success can be expected with prompt exenteration alone after a biopsy diagnosis.

Electron microscopy has been used to further identify orbital and other rhabdomyomas and rhabdomyosarcomas. With the electron microscope it is possible in most rhabdomyosarcomas to identify cells that contain well developed striated sarcomeric units or aggregates of less well developed myofilaments. Embryonic sarcomas that are composed mainly of round and spindle cells uncommonly show sarcomeric units but often demonstrate myofilament aggregates. Immuno-fluorescent studies show the latter cells to contain myosin, so it seems obvious that the aggregated filaments in these cells are myofilaments.
In view of our difficulty in demonstrating myofibrils and cross-striations in the cells of 8 of 10 rhabdomyosarcomas of the orbit we decided to study the pathologic material available in our own and other laboratories with the electron microscope.

**MATERIALS AND METHODS**

All 10 patients had excision of tumor material for diagnosis by paraffin sections and some of these had subsequent exenteration of the orbit. The paraffin blocks obtained from our own and other laboratories were processed in a method similar to that described by Zimmerman et al. Preliminary study of the paraffin sections was of great value in selecting areas to be studied. Plastic-embedded sections 1 μ thick were studied after staining with the Richardson stain or with basic fuchsin and methylene blue to determine which areas of the blocks should be further evaluated with the electron microscope. Thin sections were studied and photographed with a Siemens Elmiscope.

**RESULTS**

**CASE REPORTS**

**Case 1** This patient was seen by Dr James Quinn of Salt Lake City on January 12, 1967, because of forward and lateral displacement of the right eye and visual loss. The symptoms dated from a fall on the ice one month previously. A cyst was drained and antibiotic therapy given. After initial improvement the condition became worse and biopsy showed a probable rhabdomyosarcoma. Exenteration of the orbit was performed on March 3, 1967, followed by radiation therapy. Microscopic examination of the exenterated orbital tissues showed a pleomorphic rhabdomyosarcoma with cross-striations. This diagnosis was confirmed by Dr Lorenz Zimmerman of the Armed Forces Institute of Pathology. In June 1968 the patient received additional radiation therapy. The patient died on October 1, 1968.

**Case 2** This patient developed a small polypoid lesion that protruded through the conjunctiva in the upper nasal portion of the orbit on March 2, 1963. She was seen in consultation by Dr Crowell Beard. A biopsy, which was taken on March 14, 1963, showed an undifferentiated sarcomatous lesion without cross-striations. The orbit was exenterated on March 18, 1963. The patient died a few hours after surgery. The exenterated orbital tissues showed involvement only of the anterior orbit and nasal eye lid in the region of the levator palpebrarum tendon. Microscopic sections again showed a non-striated embryonal sarcoma. This diagnosis was also confirmed by Dr Lorenz Zimmerman of the Armed Forces Institute of Pathology.
Case 3  This patient was referred by Dr Rowland Merrill of Salt Lake City. He was first examined on April 5, 1969, after a two-week history of slight ptosis and a large chalazion-like lesion above the tarsus of his right upper lid. The lesion became larger and was excised on April 23, 1969. The microscopic sections showed an undifferentiated sarcoma, possibly a rhabdomyosarcoma. Exenteration of the right orbit was performed on April 30, 1969. The patient has had no sign of recurrence or metastasis and is presently doing well.

Case 4  A left cheek tumor was removed from this patient in 1963. It was diagnosed as an undifferentiated rhabdomyosarcoma of the masseter muscle. He was struck on the left face by a foot while he was swimming in September 1964. During the subsequent three months he had stinging and shooting pain and anesthesia of the left face. In February 1965 he developed proptosis of the left eye with chemosis and lid edema. On examination in August 1965 he showed the manifestations of the orbital apex syndrome with an almost complete paralysis of the left third, fourth, and sixth nerves, and partial anesthesia of the entire face. Hertel measurements were 14 right and 27 left with the bar at 98 mm. There was a neurotrophic keratopathy. Roentgenograms showed the antrum to be involved on the left side, so that tumor tissue was removed through a Caldwell-Luc approach. It proved again to be an undifferentiated sarcoma, probably a rhabdomyosarcoma. Radiation therapy was given to the left orbital and antral regions. All the tumor receded and the patient was alive and well in April 1972. This patient was referred by Dr Hartwig Ahlers.

Case 5  This patient was referred by Drs Thomas Neumayr and Marvin Quickert. She was born with a right proptosis, the eye being displaced up and out. Surgery was performed on September 11, 1969, after there had been rapid growth of the tumor. A hemorrhagic cystic mass was found and biopsies were taken. The sections were reviewed by several general and ophthalmic pathologists and by Dr Lorenz Zimmerman at the Armed Forces Institute of Pathology. All agreed that the tumor was an undifferentiated mesodermal malignant neoplasm. The child was treated by radiation therapy, but the parents withdrew her from treatment after only 2500 rads had been administered because they wished to consult a witch doctor on Guam. The patient returned for further radiation therapy on February 10, 1970, and no evidence of a tumor was found.

Case 6  This patient was admitted to our outpatient department on March 12, 1967, with a two-week history of a slowly growing medial orbital mass, chemosis, and some lid edema. The eye was displaced down and out. An encapsulated mass was removed from the upper nasal orbit on March 16, 1967. Microscopic examination showed an embryonal rhabdomyosarcoma of the orbit exhibiting cross-striations. Exenteration was performed on March 23, 1967. On December 5, 1967, a recurrence was noted at the orbital apex;
this was biopsied and then treated with 6366 rads of radiation during a period of six weeks. On May 6, 1968, a suspected recurrence prompted reoperation but no tumor tissue was found in the biopsy specimens. An abscess was found in the tissues at the apex of orbit, associated with a maxillary sinusitis. The patient was well and totally asymptomatic when last seen on February 3, 1972.

**Case 7**  This patient developed forward proptosis of the left eye on December 3, 1970. It evolved rapidly and was associated with marked reduction of vision and papilledema. An encapsulated tumor was removed from the muscle cone on January 15, 1971. Microscopic study showed an undifferentiated pleomorphic tumor, probably a rhabdomyosarcoma, without cross-striations. The orbit was then treated with 5440 rads of irradiation. The patient did well after this, but in October of 1971 she developed a recurrence of the tumor in the left orbit. Exenteration of the orbit was done in November of 1971. On January 7, 1972, the patient was admitted to the hospital with a recurrence of the rhabdomyosarcoma in the left orbital bones and temporal region. Additional irradiation was given in an amount of 1554 rads, but the patient died on March 26, 1972.

**Case 8**  This patient was referred by Drs Wayne Fung and Gilbert Cleasby of Pacific Medical Center, San Francisco. Sudden proptosis of the right eye occurred during the last week of April 1965. Hertel measurements were 22 mm right and 12 mm left. The right eye was both exotropic and hypertropic. The nasal disk margin was congested and slightly elevated. Six hundred rads of radiation therapy were given with some improvement. A mass could be felt in the orbit about a month later and exploration revealed a diffuse tumor. The biopsy showed a malignancy and exenteration was performed on June 11, 1965. Microscopic studies showed an undifferentiated sarcoma of the orbit morphologically consistent with rhabdomyosarcoma. No cross-striations were found. The patient was lost to follow-up.

**Case 9**  Left exophthalmos was noted in November 1957 during the time the patient was hospitalized for a febrile respiratory and urinary infection. By January 1958 the proptosis was worse and a mass could be felt at the upper inner canthal region. Exploration showed an encapsulated orbital tumor, and biopsy showed a possible neuroblastoma. The patient was referred for radiation therapy, which was given over a three-week period, but the tumor continued to increase in size. Review of the biopsies suggested the lesion might be a myoblastoma. Exenteration was done on February 10, 1958. Most of the tumor was within the muscle cone. Microscopic study showed an undifferentiated tumor, probably a rhabdomyosarcoma, but cross-striations were not found. The patient died within the next year.

**Case 10**  This white female, age 8 months, had an enlargement in the region
Table 2. Clinical Findings and Histology

<table>
<thead>
<tr>
<th>Case</th>
<th>Race</th>
<th>Sex</th>
<th>Age</th>
<th>Orbit</th>
<th>Location in orbit</th>
<th>Cross-striations</th>
<th>Course</th>
<th>Type</th>
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<tbody>
<tr>
<td>1</td>
<td>W</td>
<td>M</td>
<td>10</td>
<td>R</td>
<td>Lower nasal</td>
<td>+</td>
<td>D**</td>
<td>Pleomorphic</td>
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<tr>
<td>2</td>
<td>W</td>
<td>F</td>
<td>3</td>
<td>R</td>
<td>Upper nasal</td>
<td>0</td>
<td>D</td>
<td>Embryonal</td>
</tr>
<tr>
<td>3</td>
<td>W</td>
<td>M</td>
<td>10</td>
<td>R</td>
<td>Upper nasal</td>
<td>0</td>
<td>A&amp;W*</td>
<td>Embryonal</td>
</tr>
<tr>
<td>4</td>
<td>W</td>
<td>M</td>
<td>63</td>
<td>L</td>
<td>Inferior temporal</td>
<td>0</td>
<td>A&amp;W*</td>
<td>Undifferentiated</td>
</tr>
<tr>
<td>5</td>
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<td>3 wks</td>
<td>R</td>
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<td>0</td>
<td>A&amp;W*</td>
<td>Undifferentiated</td>
</tr>
<tr>
<td>6</td>
<td>W</td>
<td>M</td>
<td>8</td>
<td>L</td>
<td>Upper nasal</td>
<td>+</td>
<td>A&amp;W*</td>
<td>Embryonal</td>
</tr>
<tr>
<td>7</td>
<td>W</td>
<td>M</td>
<td>5</td>
<td>L</td>
<td>Central</td>
<td>0</td>
<td>D**</td>
<td>Undifferentiated</td>
</tr>
<tr>
<td>8</td>
<td>W</td>
<td>F</td>
<td>4 mo.</td>
<td>R</td>
<td>Upper nasal</td>
<td>0</td>
<td>Lost to follow-up</td>
<td>Undifferentiated</td>
</tr>
<tr>
<td>9</td>
<td>W</td>
<td>F</td>
<td>13 mo.</td>
<td>L</td>
<td>Central</td>
<td>0</td>
<td>D**</td>
<td>Undifferentiated</td>
</tr>
<tr>
<td>10</td>
<td>W</td>
<td>F</td>
<td>8 mo.</td>
<td>R</td>
<td>Lateral</td>
<td>0</td>
<td>D**</td>
<td>Undifferentiated</td>
</tr>
</tbody>
</table>

*A&W: Alive and well.
**D: Dead of disease.

of the right parotid gland. It was thought that it was a branchial cleft cyst. It was partially removed and a diagnosis of mixed tumor was made. The child was well until October 1968 when beginning exophthalmos of the right eye was noted. When seen by Dr Harvey Baker in December there were 4 to 5 mm of exophthalmos and a corneal ulcer due to exposure. A mass was found that involved the parotid gland, the temporal region, and the orbit. Roentgen studies showed destruction of the bones in this area. Radical surgery was performed in an attempt to remove all of the tumor. Microscopic study showed a probable myxoid rhabdomyosarcoma. A diligent search was made, but no evidence of cross-striations could be found. The patient received cobalt radiation therapy and chemotherapy, but became increasingly ill and died in mid-1969. The specimens were referred by Dr Merrill Reeh of Portland, Oregon.

Table 2 shows the clinical findings and histologic evaluation in paraffin sections of the 10 patients.

Electron Microscopy

Specimens from patients no. 1, 5, 6, 7 and 9 show sarcomeric units; two of these show well defined z bands, often aligned in register with those
FIGURE 1

A: Light micrograph from Case 6 showing large rounded cells with an abundant cytoplasm. Striated filaments are seen around the nucleus (arrows). × 520.

B: Light micrograph from Case 7. Two spindle-shaped cells shows cross-striations (arrows). × 520.
FIGURE 2. CASE 1
This cell shows aggregates of thick and thin myofilaments. There are no z bands.
× 27,500.
FIGURE 3. CASE 2

A: Small groups of filaments are clustered fairly close to each other. Within the mass the bundles of myofilaments are parallel. × 18,000.

B: Higher magnification of aggregated myofilaments in another cell. × 45,000.
FIGURE 4. CASE 3
A portion of a cell containing bundles of myofilaments without distinct banding. Loosely arranged filaments are also seen throughout the cytoplasm (arrows). × 21,200.
FIGURE 5. CASE 4
A cell that contains a mass of myofilaments. The filaments here show no tendency to form bundles. Some are cut in cross section (a), and some in longitudinal section (b). × 18,500.

FIGURE 6. CASE 5 (opposite)
Portion of a cell seen at low magnification. The cytoplasm contains numerous short aggregated clumps of myofilaments, none showing cross-striations except at (a). Z band-like densities were found in many cells in this tumor. × 15,500.
of other units to form broad cross-striations (Figures 1, 6, 7, 8, 10) while the other three have aggregations of myofilaments resembling sarcomeric units but with less distinct z bands. The presence of the fibrils and z bands, however, is sufficient to establish the nature of the units. In all five specimens groups of actomyosin filaments of the thick and thin variety can be identified, the thick measuring around 170 Å and the thin 75 to 80 Å in width. The z bands in well developed units are 950 Å in width. These measurements are in conformity with those of Kroll and others.

Six specimens show cells containing small to large numbers of aggregated cytoplasmic myofilaments that are randomly scattered (Figures 2, 3, 4, 5, 9, 11). In some cells the filaments form striking bundles while in others they are more diffuse.

In all specimens the filaments are found in those cells that are spindle-shaped as well as those which contain an abundant cytoplasm. They are often prominent in those cells that form alveolar patterns.

Unlike adult striated muscle we find no tendency for longitudinal alignment of mitochondria and endoplasmic reticulum. None of the cells containing well defined sarcomeres show a surrounding basement membrane or hemidesmosomes along the cell membrane. Crystals or crystalloid structures also are not found in the cytoplasm of any of these cells. One tumor showed nuclear inclusions suggestive of viral inclusions (Figure 8c, d). These are not believed to be an artefact of preparation of the tissues.

**DISCUSSION**

Electron microscopy can be of value in determining the nature of some types of orbital tumor. If routine hematoxylin and eosin and special stains do not show cross-striations, and if the type of tumor is questionable, electron microscopy should be employed. The findings in these specimens suggest that once the pathologist becomes familiar with the reading of plastic-embedded specimens 1 μ thick, stained with Richardson stain or with basic fuchsin and methylene blue, the accuracy of diagnosis of these tumors may be improved.

**FIGURE 7. CASE 6 (opposite)**

A: Cross-striations were found with the light microscope in this case. Bundles of actomyosin exhibit well defined z bands (a), as well as I bands (b). × 15,500.

B: Another cell from the same tumor. This and many other cells exhibit actomyosin filaments and no z bands. × 27,500.
Orbital Rhabdomyosarcoma

FIGURE 9. CASE 8
Many cells of this tumor contained bundles of myofilaments without a tendency to form cross-striations. × 35,500.

FIGURE 8. CASE 7 (opposite)
A: Low-power view of a tumor cell showing bundles of myofibrils in different portions of the cytoplasm. Rare z bands are present in the bundle at the left (a). Definite z band densities are present in the group at the right (b). × 3,690.
B: Higher magnification of A. Bundles of myofilaments (a) are evident. Some are thick and some thin. Two z bands are seen (b). × 35,000.
C and D: These two photographs show virus-like particles (arrows) measuring approximately 100 mμ in diameter. They possess a dense nucleoid measuring approximately 48 mμ in diameter. c, × 8,250; d, × 45,000.
Randomly displaced myofilaments within the cytoplasm of a tumor cell. × 20,500.

**FIGURE 10. CASE 9 (opposite)**

A: Bundles of myofilaments in the cytoplasm tending to form sarcomeres (a). Occasional densities along their courses represent z bands. × 15,000.

B: Another cell from a different block in the same tumor. Cytoplasmic filaments are aggregated somewhat in the form of sarcomeres, but no banding is present. × 26,500.
That the non-banded aggregates of filaments in the cells of five of the ten specimens are really myofilaments seems evident for the following reasons: the dimension of the thick and thin filaments is identical with actomyosin filaments; they have been shown by others to be positive for myosin by immunofluorescent techniques, and biochemical studies have shown the cells to contain myosin.

The presence of viral particles in mouse rhabdomyosarcoma has been demonstrated. Moloney sarcoma virus (MSV) induces rhabdomyosarcoma in mice that is identical in almost every way with childhood rhabdomyosarcoma. Electron microscopy of the MSV-induced sarcoma showed numerous virus particles indistinguishable from the viruses of the murine leukemias, but electron microscopy of six human tumors failed to reveal viral particles.

**SUMMARY**

Specimens of orbital rhabdomyosarcoma from ten patients were studied by light and electron microscopy. Two tumors showed cross-striations of cells when examined by light microscopy. With the electron microscope five tumors showed cells that contained sarcomeric units with z bands. Six tumors showed cells that contained aggregates of myofilaments scattered randomly throughout the cytoplasm. The reasons for believing these are myofilaments are their dimension and the presence of thick and thin filaments having the dimension of actomyosin filaments.

One of the ten tumors showed particles in the nuclei that conform to the size and structure of the viral particles producing rhabdomyosarcoma in mice.

**REFERENCES**

DISCUSSION

Dr. J. Reimer Wolter. It has been a pleasure and a privilege to read this excellent paper well before it was presented here today. To give a more complete discussion I also asked Dr. Paul W. Gicas and Dr. Theodore F. Beals, the electron microscopists in the University of Michigan Pathology Department, to read the paper and to make comments.

Both of these experts were very impressed with the good quality of the micrographs which show only few minor artifacts. They wanted me to ask, for their own information, whether or not all of the presented micrographs were made from de-paraffinized previous routine paraffin-embedded material.

Our second question concerns the criteria for electron microscopic identification of rhabdomyosarcomas. In their introduction the authors list two histologic requirements: the presence of striated sarcomeric units, or the identification of aggregates of less well developed myofilaments. In Case 4 (Figure 5), however, the authors show no sarcomeric units and no bundling of myofilaments. Is this sufficient to make the diagnosis?

In the text the authors discuss the difference between thick and thin actomyosin filaments, but these are not pointed out in the figures.

We are impressed with the potential of the 1 μ thick sections as the authors describe them for better orientation and diagnosis in tumor tissue of this kind. There can be no doubt not only that the authors have presented a beautiful piece of research, but that electron microscopic study has become a practical tool for better diagnosis and prognosis in orbital tumors of this type. When I say this I have to add that light microscopy in our hands has so far given all the answers that we have needed for proper diagnosis, prognosis, and direction of treatment. Some would be disappointed if I would not state here that silver stains also serve well to demonstrate filaments with and without striations which are otherwise difficult or impossible to see.

At this point I would like to ask the authors whether or not the commonly used classification into embryonal, alveolar, and differentiated types of rhabdomyosarcoma should be kept in spite of the fact that they are able to demonstrate some differentiation in virtually all these tumors.
With great emphasis I would like to state that the best histopathological study will be of little practical help if the diagnosis is not made early in the clinical course of the developing orbital rhabdomyosarcoma. The ophthalmologist has to think of this neoplasm every time he sees a child with a quickly enlarging lesion in the orbital region. A biopsy has to be obtained early. In typical histologically confirmed rhabdomyosarcoma we do orbital exenteration, radiation, and chemotherapy in the quickest possible sequence. Our technique and results have been outlined by Dr Ruth M. Heyn in the Journal of Pediatric Ophthalmology, 8:147, 1971.

My final statement: much too often, in too many patients — and also in some of the patients described in this paper — too much time is lost before the truly aggressive treatment that is necessary to control this very malignant neoplasm is completed.

Dr Hogan, I want to thank Dr Wolter for his very kind discussion. As usual, he gets right to the point and asks all the proper questions. I am sure I can’t answer all of them to his satisfaction.

All of the specimens that you saw today were first imbedded in paraffin, and then the proper areas were disimbedded, refixed, and eventually processed in just the manner Dr Zimmerman described last year in his Adademy lecture. So they are remarkably good sections, considering the amount of handling of tissues that occurred.

The criteria to establish the diagnosis of these tumors are correct. The electron microscopists who advised Dr Wolter were correct: these tumors cannot be diagnosed unless you have striations or aggregates of myofilaments by electron microscopy.

In Case 4 we showed a picture of the myofilaments aggregated in a large ball-like mass. Many tumor cells in this particular specimen also contained myofilament aggregates. There wasn’t much doubt that this was a rhabdomyosarcoma both on the basis of the masseter muscle involvement as well as the orbital and sinus biopsies.

Actin and myosin filaments can be identified in most of these tumors but not all of them. Thick and thin filaments can be identified. The thick ones are about 170 Å in width, and the myosin filaments are about 70 to 80 Å. It can be proved that these are actinomycin filaments by two methods: (1) by immuno-fluorescent techniques which have been quite well developed, and (2) biochemically.

I am sure the method Dr Wolter uses of silver impregnation of cells would be successful in identifying fibrils in these tumors. I don’t know whether they would increase the likelihood of establishing a diagnosis of rhabdomyosarcoma, and I don’t know what the time involved in preparing the sections by this method is. From the standpoint of time, if a patient has an excision of an orbital rhabdomyosarcoma, the tumor can be divided and one portion can be processed in paraffin and the other by electron microscopy; in four days one
can have 1 μ sections to identify the tumors, as I showed here. So there isn’t very much time lost in the management of these tumors.

I feel that the day when we will classify rhabdomyosarcomas as they have been in the past is about over. There is no evidence that the classification now used has any value from a prognostic or therapeutic standpoint.

I was aware of the papers that have been published on therapy, and I tried to stay away from the question of treatment of these tumors because I think it is going to be quite a while yet before we have the final answer on therapy of rhabdomyosarcomas.