

Spontaneous Complex Odontoma in a Sprague-Dawley Rat

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ABSTRACT. Complex odontoma from a female Sprague-Dawley rat is described histopathologically. Necropsy revealed a hard (bony), white mass (3.0 × 3.0 × 2.1 cm) on the left mandible. Microscopically, the mass consisted of islands or nests of epithelial and mesenchymal elements that formed abortive tooth structures. In other areas, tooth formation consisted of a pulp cavity lined by layers of odontoblasts, dentin, enamel, and ameloblasts. Concerning all features of normal tooth formation which was differentiated and mineralized yet completely disorganized, the diagnosis of complex odontoma was recommended.

KEY WORDS: complex odontoma, odontogenic tumor, Sprague-Dawley rat.

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Odontogenic neoplasms are rare in rats. They are named according to their degree of differentiation. Tumors with only differentiated odontogenic epithelial components are named ameloblastoma. Tumors in which epithelial cell components coexist with formation of dental matrix structures such as dentin and enamel are named odontomas. Odontomas are further subdivided according to morphological features and degree of organization. Compound and complex odontomas are the most differentiated tumors among the dental tumors. All features of normal odontogenesis, such as ameloblastic epithelium, organized dentin matrix formation, and enamel matrix formation, are observed in these tumors. The arrangement of these elements is disorderly in the complex odontoma, while the components are in an orderly pattern which resembles a developing tooth in the compound odontoma. An ameloblastic odontoma contains abundant epithelium in addition to the dental tissues [8, 9, 11].

The literature contains several reports of odontogenic neoplasms in rats. These include ameloblastic odontoma (odontoameloblastoma) [1, 5, 7], odontogenic fibroma [6] and ameloblastoma [4, 10]. A spontaneous complex odontoma in rats has not been reported previously. The purpose of this case report is to describe the morphological features of a dental tissue tumor observed as an incidental finding in a Sprague-Dawley rat during a chronic toxicity study.

The present case was observed in a female Sprague-Dawley rat in the middle dose group of a carcinogenicity study. The Sprague-Dawley rat was housed in a polycarbonate cage with hardwood beddings, which was provided for one or two animals per cage. The animal was fed commercial mouse pellets and water *ad libitum*. Environmental conditions was controled ambient temperature at 23 ± 2°C, rela-

tive humidity at 50 ± 5%, and lightening at a 12-hr cycle. The animal was sacrificed at the end of the study by decapitation when it was 33 weeks old. Necropsy revealed a hard (bony), white mass (3.0 × 3.0 × 2.1 cm) on the left mandible. Tissues were fixed in 10% buffered formalin, routinely processed, and stained with hematoxylin and eosin.

Histologically, the mass consisted of islands or nests of epithelial and mesenchymal elements that formed abortive tooth structures (Fig. 1). The surrounding acellular material contained two irregularly demarcated layers. The layer apposing to the mesenchyme was homogeneous and eosinophilic (predentin) while the adjacent outer layer was darker eosinophilic (dentin). Adjacent to the predentin there was an ill-defined, single layer of cuboidal to flattened cells (odontoblasts) which blended into loosely arranged mesenchymal tissue (pulp) (Fig. 2). In some areas, a zone of finely-laminated, deep eosinophilic materials (enamel) was adjacent to the layers of dentin (Fig. 3). There was a single layer of tall columnar cells with round basal nuclei and abundant eosinophilic cytoplasm (ameloblasts) showing palisading arrangement in opposite to the dentin layer (Fig. 3). The cysts which contained disorganized structures slightly resembling developing teeth were scattered throughout the tissues (Fig. 4). Mitotic figures were rare. Concerning all features of normal tooth formation which was differentiated and mineralized yet completely disorganized, the diagnosis of complex odontoma was recommended.

According to the induction theory of odontogenesis, the ameloblastic epithelium in some way promotes the surrounding mesenchymal cells to become odontoblasts. The odontoblasts produce dentin. Dentin is necessary to enable the ameloblasts to form enamel. Thus, neoplasms composed entirely of epithelium are unable to produce hard tissues. Such neoplasms are termed ameloblastomas [3]. Those neoplasms which contain hard tissues and are mixed

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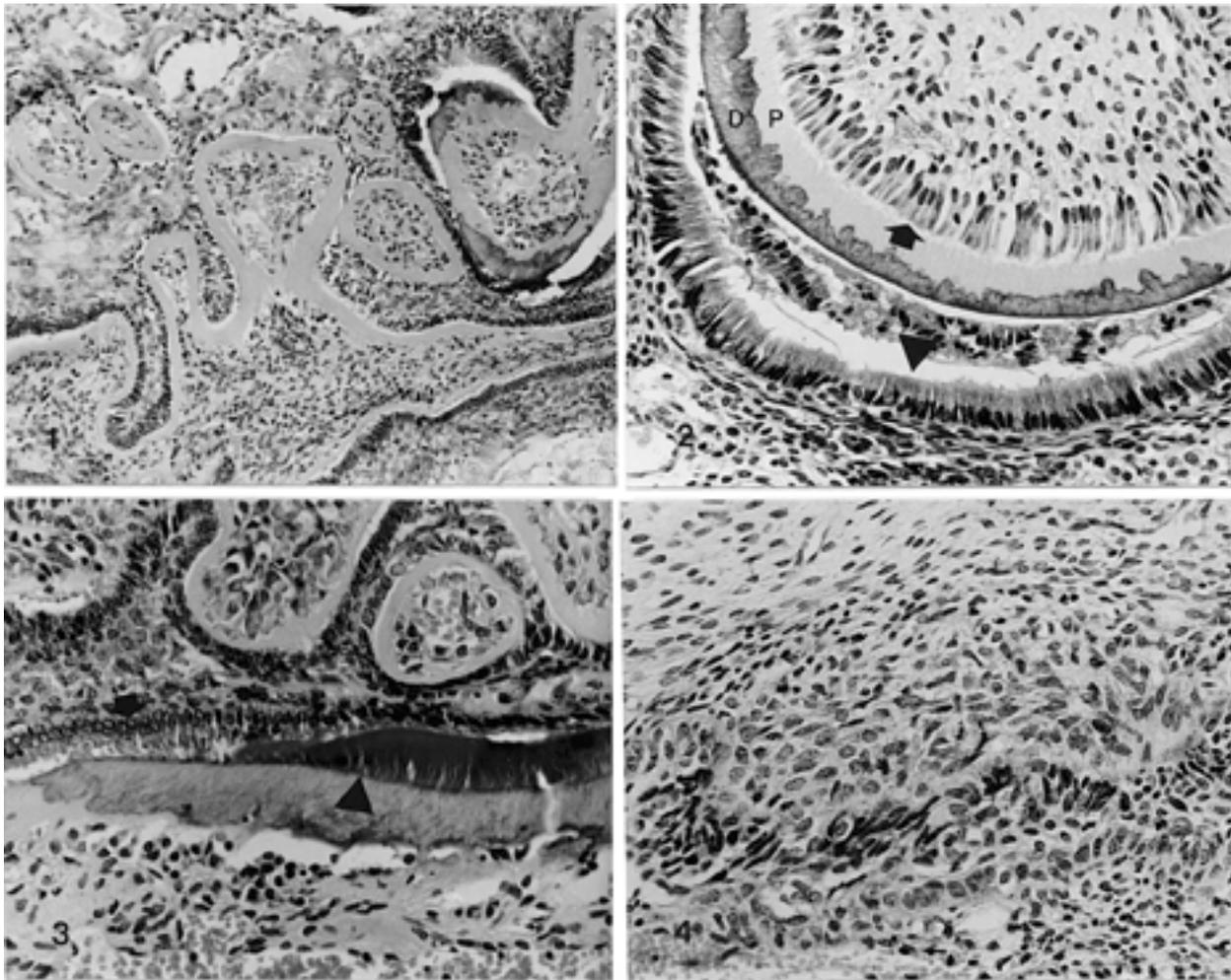


Fig. 1. Complex odontoma shows nests of tooth-like structures. H&E $\times 200$.

Fig. 2. Complex odontoma contains two irregularly demarcated layers; predentin (P) and dentin (D) with odontoblasts (arrow) and ameloblasts (arrow head) in palisading arrangements. H&E $\times 400$.

Fig. 3. Complex odontoma shows enamel (arrow head) with ameloblasts (arrow). H&E $\times 400$.

Fig. 4. Complex odontoma shows purely epithelial structures reminiscent of early odontogenesis. H&E $\times 200$.

with epithelial and mesenchymal origins, are termed odontomas [8, 11].

The etiology of odontomas is unknown. Some have suggested that local trauma or infection may lead to this tumor. The continuously growing incisors of rats are very sensitive to traumatic alteration. In addition to trauma and infection, a relationship with disturbed eruption due to malocclusion may be another possibility [12]. Although spontaneously occurring odontomas are rare in rats, several protocols exist for the experimental induction of rat odontomas. A total of 29 odontogenic neoplasms were found in 134 rats exposed to a single dose of methylnitrosourea into the portal vein (0.4 mmol/kg body weight) following partial hepatectomy [2]. Similar odontogenic neoplasms have also been observed in two of a group of 30 young male Sprague-Dawley rats that survived for 280 days after a single intraperito-

neal injection of a high dose of N-ethyl-N-methylnitrosourea [13].

The present case was considered a naturally occurring complex odontoma since this was the only case observed in this carcinogenicity study. This tumor caused no apparent clinical sign in the rat and had not been noticed until necropsy. The necropsy finding of smooth, distinct boundaries suggests that the mass was a slow-growing tumor. Similar tumors occur in humans, but are rare [9]. They are slow-growing and locally destructive but they do not metastasize.

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