Rabbit Rhinitis: A Diagnostic Approach

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INTRODUCTION

Respiratory diseases are amongst the most common reasons for rabbits to present for veterinary attention.[1] Owing to the large functional reserve of the cardiorespiratory systems and their tendency to mask symptoms of disease, many rabbits are presented late in the course of disease. Chronic pathologic processes may continue unabated and result in chronic morbidity and mortality. Limited space only allows for the briefest of descriptions here, but extensive reviews of rabbit respiratory medicine are available in the references. An accurate appreciation of rabbit respiratory anatomy and physiology has implications not only for disease investigation and treatment.[2,3]

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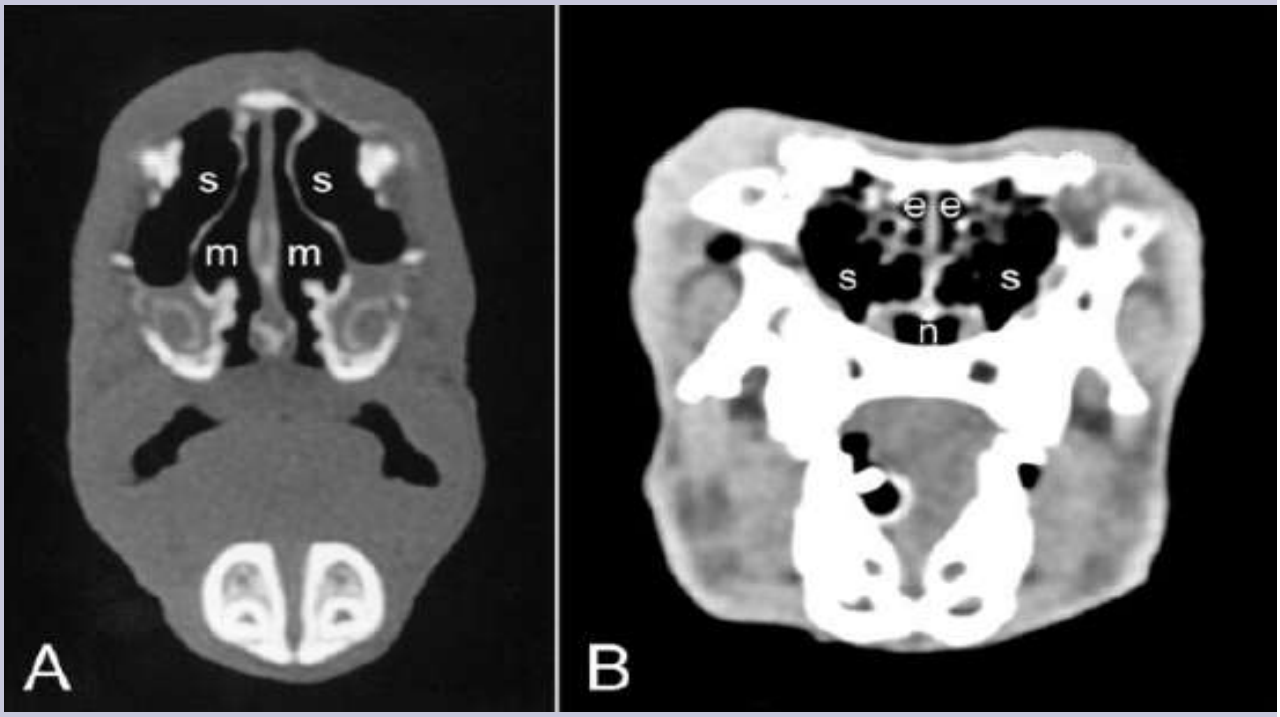
RESPIRATORY ANATOMY

Air enters the nasal cavity through the nostrils, past the alar folds, and enters the nasal cavity. The rhinarium is divided into left and right nasal cavities by a cartilaginous nasal septum, and separated from the oral cavity by the hard palate. Each nasal cavity contains dorsal and ventral nasal conchae (turbinates), and more caudally, the endoturbinates. The recesses between these conchae are termed the meati, and in the rabbit there are dorsal, medial and ventral meati that connect to the maxillary and ethmoid paranasal sinuses via ostia (Figures 1 and 2). The long nasopharynx extends to the larynx where the epiglottis is engaged over the caudal rim of the soft palate, thereby permitting the unobstructed movement of air from nasal cavity, through the glottis, and into the trachea.

Approaching the larynx from the oral cavity reveals the soft tissue wall formed by the epiglottis engaged over the caudal soft palate. To expose the glottis and gain access to the trachea from an oral approach this anatomical relationship must be disrupted by elevating the soft palate to allow the epiglottis to fall ventrally. The trachea is composed of vascular smooth musculature and leads to the bifurcation and primary bronchi, which further divide into secondary bronchi and bronchioles before terminating at alveoli.

Figure 1



Computed tomography scans of the normal rabbit skull. (A) Anterior CT scan demonstrating the anterior paired maxillary sinuses (s) and the medial nasal meati (m); (B) Posterior CT scan demonstrating the posterior paired maxillary sinuses (s), paired ethmoid sinuses (e), and the nasopharynx (n).

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Figure 2

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Endoscopic views of the normal rabbit respiratory system. (A) View of the left anterior nasal cavity just caudal to the nostril demonstrating the alar fold (a) and nasal septum (n); (B) View within the medial nasal meatus of the left nasal cavity illustrating the turbinate structures (te) and nasal septum (n); (C) View within the caudal ventral meatus demonstrating the endoturbinates (e) and nasal surface of the soft palate (s); (D) Pharyngeal view showing the caudal tongue (t) and the normal position of the leading edge of the epiglottis (black arrows) engaged over the caudal rim (white arrows) of the soft palate (s); (E) Same pharyngeal view following the dorsal displacement of the soft palate (s) to permit the epiglottis to fall ventral revealing the epiglottis (e), cuneiform processes (c) and glottis (arrow); (F) View of the trachea demonstrating the vascular smooth musculature (m) and the dorsal ligament (d); (G) View of the tracheal bifurcation revealing both primary bronchi (arrows); (H) View from the tracheal bifurcation looking inside a primary bronchus (b) and demonstrating two secondary bronchi (arrows); (I) Thoracoscopic view illustrating the caudal right lung lobe (l).

Respiratory Physiology

Rabbits are obligate nasal breathers and any obstruction within the nasal cavity will result in a dramatic increase in respiratory noise and effort. Breathing is mainly diaphragmatic with normal resting respiratory rates around 30–60 per min. Open-mouth breathing is a poor prognostic sign and is most often seen when disease is advanced.

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Causes of Rhinitis[1]

Trauma

Rabbits are inquisitive animals that if permitted to roam unsupervised can sustain various injuries. Bites from other pets, particularly dogs, rocker chair injuries, wounds from falling objects, being dropped, and chewing through electrical cables are examples. Soft tissue and skeletal injuries to the head can result in respiratory signs including dyspnea and emphysema, and most are evaluated as emergencies. Iatrogenic trauma to the glottis of rabbits is not uncommon following repeated failed attempts at tracheal intubation. Glottal swelling may result in dyspnea, increased respiratory noise, and if severe hypoxia and death.

Foreign Bodies

While chewing and choking on foreign bodies such as coins, pieces of rubber, grass seeds, and elastic bands can cause them to lodge in the nasal meatuses, pharynx, glottis or trachea, such objects are rare. More commonly, shards of hay have caused sneezing which if not promptly removed have acted as a nidus for chronic infections.

Immunologic Diseases

Allergic diseases such as asthma have been anecdotally reported in rabbits but apart from experimentally induced conditions, no clinical reports could be found in the peer-reviewed literature. However, many cases of rhinitis, sinusitis and pneumonia are primarily associated with environmental issues (e.g., inadequate humidity, high environmental temperatures, poor air quality), which is unresolved may develop a secondary bacterial component. Nasal flushing using saline under anesthesia coupled and improvements in the environment (e.g., the use of air filters) can often be more productive (and less harmful) than repeated courses of antibiotics.

Dental Disease

Maxillary tooth root overgrowth can impinge into the maxillary and orbital sinuses, resulting in partial obstruction and inspiratory rales. Perforation of the apical region of maxillary teeth into a sinus can occur, with secondary bacterial infection occurs resulting in abscessation and osteomyelitis. Abscesses may result in maxillary or retrobulbar swelling, and fistulate into the nasal cavity resulting in chronic sinusitis and rhinitis.

Cranial Masses

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Masses outside the respiratory system may exert extraluminal pressure and exert respiratory compromise. Abscesses, granulomas, or neoplasms affecting the head (e.g., dental abscess), neck, or thorax (e.g., lymphoma, thymoma) may compress closely associated respiratory structures. Although the respiratory signs are secondary and the primary condition needs attention, respiratory disease may be an important component.

Viral Diseases

Reports of viral diseases affecting the respiratory system of rabbits are rare. Myxoma virus has caused oculonasal discharge and pneumonia in protracted cases, while rabbit haemorrhagic viral disease may cause hemorrhage from the nose, mouth and within the respiratory tract. In addition, research studies have demonstrated infection with Sendai virus, herpes simplex, and infectious bovine rhinotracheitis virus, although these are unlikely to become important clinical entities in practice.

Bacterial Diseases

The most notorious respiratory pathogen of rabbits is *Pasteurella multocida*.[4,5] *Pasteurella* is considered a commensal organism of the nasopharynx, and therefore demonstration of *Pasteurella* alone (in non-SPF rabbits) without demonstration of a host pathological or immunological response does not definitively indicate disease. Poor husbandry and malnutrition can predispose to pasteurellosis with signs associated with rhinitis,

conjunctivitis, tracheitis, pneumonia, pleuritis, and septicemia. The main routes of transmission are direct contact, air-borne spread and fomites. Variability in virulence and antimicrobial efficacy necessitates cultures and sensitivity testing. *Bordetella bronchiseptica*, *Staphylococcus aureus*, *Staphylococcus epidermidis*, *Streptococcus faecalis*, *Klebsiella pneumonia*, *Micrococcus luteus*, *Escherichia coli*, *Streptococcus zooepidemicus*, *Pseudomonas aeruginosa*, *Bacillus* sp., *Moraxella catarrhalis*, *Enterobacter agglomerans*, *Proteus mirabilis*, *Pseudomonas paucimobilis*, *Pseudomonas diminuta*, *Alcaligenes faecalis* and *Escherichia coli* have also been isolated from the upper respiratory tract of clinically healthy rabbits.[6] *Mycobacterium*, *Mycoplasma* and *Chlamydophila* have also been demonstrated within the respiratory tract of rabbits with respiratory disease.[18,19] Attributing pathogenicity to any bacterial isolate can be challenging without demonstrating an immunologic or pathologic host response. Therefore, a combination of culture/PCR with biopsy histopathology or cytology is essential to make a definitive diagnosis.

Mycotic Diseases

Although natural mycotic respiratory diseases have not been reported, experimental zygomycosis, aspergillosis and penicilliosis have been documented, and generally require immunosuppressive therapy and heavy exposure.

Parasitic Diseases

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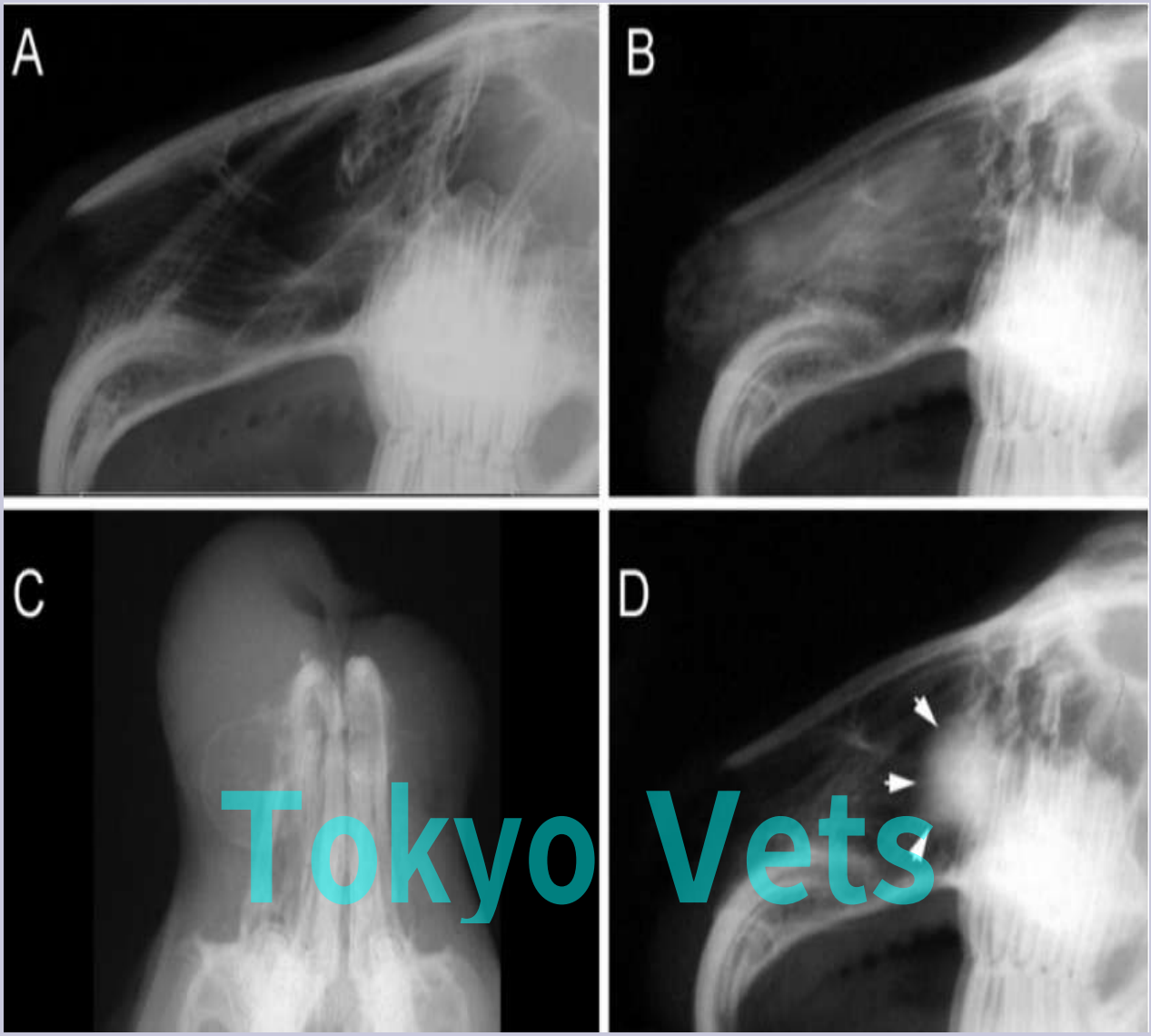
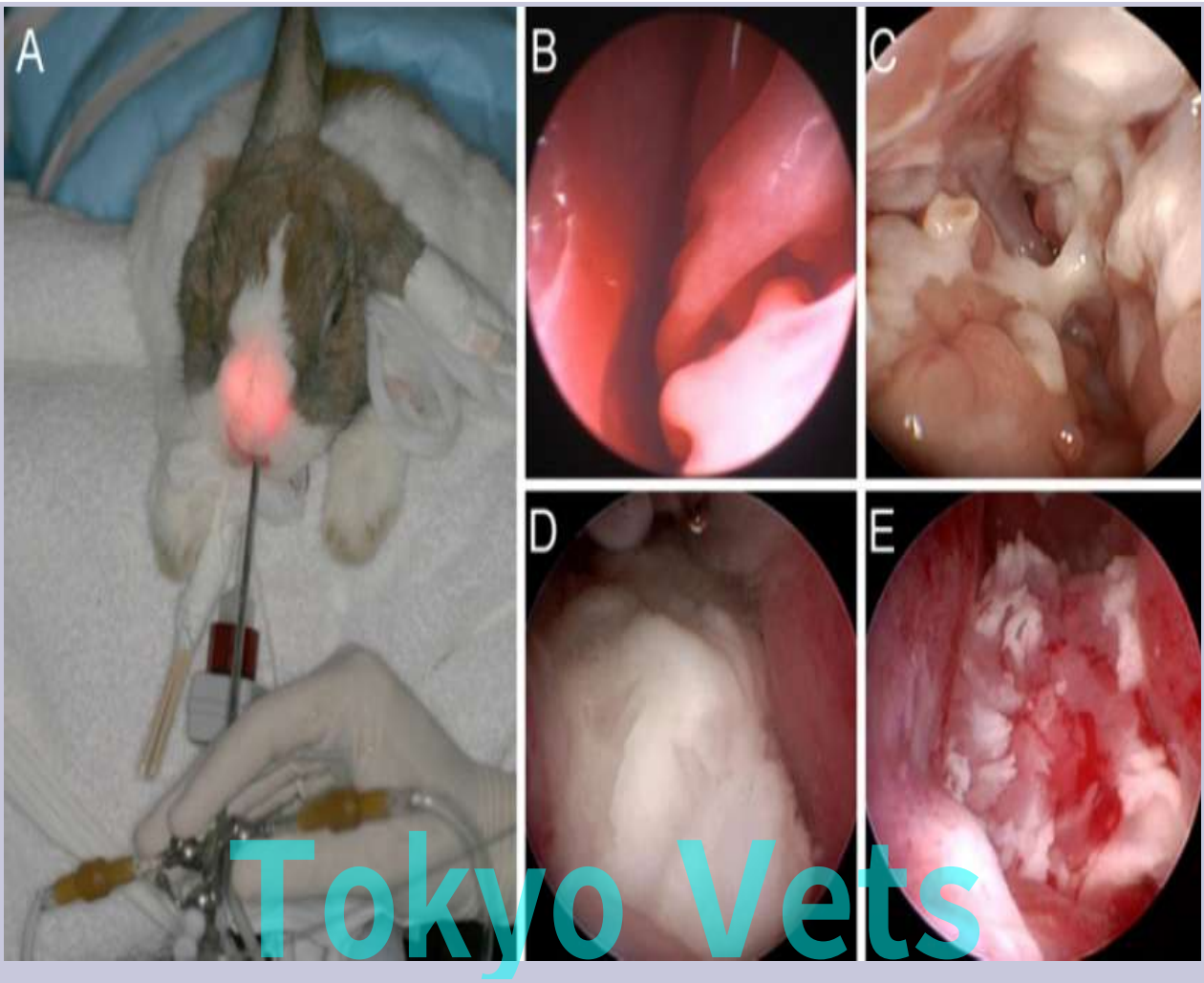
No reports of parasitic respiratory disease in rabbits have been documented. Heartworm has not been reported in rabbits.

Figure 3



Nasal radiographs from rabbits. (A) Radiographic appearance of a normal nasal cavity in a healthy rabbit (right lateral). (B) Diffuse increase in soft tissue density within the dorsal nasal cavity in a rabbit with chronic rhinitis (right lateral). (C) Nasal abscessation with boney destruction and mineralization, primarily affecting the right side of the rhinarium. This rabbit presented with dyspnea, nasal discharge, a broken incisor (dorsoventral). (D) Focal increase in soft tissue density (arrows) within the caudal aspect of the nasal cavity that on endoscopic biopsy proved to be an abscess.

Figure 4



Anesthetized rabbit undergoing rhinoscopy. (B) View of healthy turbinates from within the middle nasal meatus. (C) Generalized destruction of the nasal septum combined with granulomatous tissue changes throughout characterized this nasal of nasal mycobacteriosis. (D) Nasal abscess found within the ventral nasal meatus close to the opening of the nasopharynx. (E) The same area following endoscopic debridement.

Diagnostic Techniques

The diagnostic evaluation of a rabbit with evidence of respiratory disease should start with a thorough review of husbandry and past medical history, followed by a complete physical examination. The examination should include detailed visual appraisal as well as palpation of the head, neck and thorax, and auscultation of the nasal sinuses, trachea, thorax and abdomen. Rabbits are fastidious groomers and oculonasal discharges are frequently cleaned using the forepaws resulting in staining of the medial metacarpi. Conjunctivitis is common with upper respiratory tract infection and results in epiphora, exudate, and periorbital alopecia. Dacryocystitis is common and the duct may become obstructed resulting in chronic epiphora.

Blood Collection

Blood can be easily collected from the marginal ear, cephalic, jugular or lateral saphenous veins, although sedation may be required. Hematology is often unrewarding as most rabbits with even severe infectious rhinitis often fail to demonstrate a significant leukocyte response. While plasma biochemistry is less useful, *Pasteurella* serology can be useful remembering that only paired, rising titers can be used to document active infection. A single positive titer means little as *Pasteurella* is a normal commensal of the rabbit upper respiratory tract.

RADIOGRAPHY

Skull survey films include left and right lateral, left and right oblique, and dorsoventral views. In addition, intraoral films of the rhinarium (without superimposition of the mandible) may be helpful but are very difficult to obtain.

ENDOSCOPY[7]

With the animal intubated and in sternal recumbency in a 10–20° head-down position, the oropharynx is packed with moistened gauze. Rabbits are prone to react to nasal endoscopy even at surgical planes of anesthesia, and therefore the use of opiates and a short-acting neuromuscular blocker (atracurium, 0.3 mg/kg IV) is recommended. The nasal cavities are flushed using warm sterile saline to remove any debris and excess mucus from the nasal cavities. The use of towels under the head helps prevent flooding of the table and floor. For animals over 2 kg the 2.7 mm telescope is used, but for smaller animals the 1.9 mm sheathed telescope is preferred. Using a sheath enables intra-operative flushing to maintain visualization; however, in small animals the naked telescope can be used with care along with intermittent syringe flushing through the nostrils. The ventral and middle nasal meati can be exploited to examine the ventral and middle conchae. In larger animals the endoturbinates and opening to the nasopharynx can also be seen. Care is required to avoid damaging the delicate nasal turbinates that are prone to haemorrhage. The telescope should be kept as medial as possible and always kept within the meati. Even so, haemorrhage can rarely be completely avoided. Exudates, abscesses, masses, and foreign bodies can be appreciated and biopsied or removed.

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The recent advent of 2 and 3 mm rigid instruments also permits biopsy and debridement within the nasal or paranasal sinuses via limited surgical access. Even when extensive surgical rhinotomy is performed, access is still often limited in small herbivores; however, the telescope enables detailed evaluation including those areas cranial and caudal to the surgical site.

COMPUTED TOMOGRAPHY (CT)

The bone-air interface of the rhinarium makes CT and ideal imaging tool, and even preferable to magnetic resonance imaging (MRI) in most cases. Although largely restricted to referral practices, CT is increasingly available and affordable, and can be especially useful for identifying mass effects within the rhinarium (Figures 5 and 6).

BIOPSY

Ultimately, the means to a diagnosis requires (i) demonstration of a host pathologic process by histopathology, cytology, or paired rising serologic titers, and (ii) identification of the causative agent generally by microbiology, parasitology, or toxicology. Histopathology is preferred and considered a gold standard, but samples are more difficult to obtain and require endoscopy, CT-guidance, or surgical rhinotomy. Paired rising titers are also reliable but what few tests are available still take 2–3 weeks for an answer. Samples for cytology are more easily obtained by swab or nasal flush, but cytology is less precise and more likely to give false results. Currently, the author recommends rhinoscopy with biopsy because it is minimally invasive, readily available in practice, cost effective, and provides definitive results in most cases.

Figure 5

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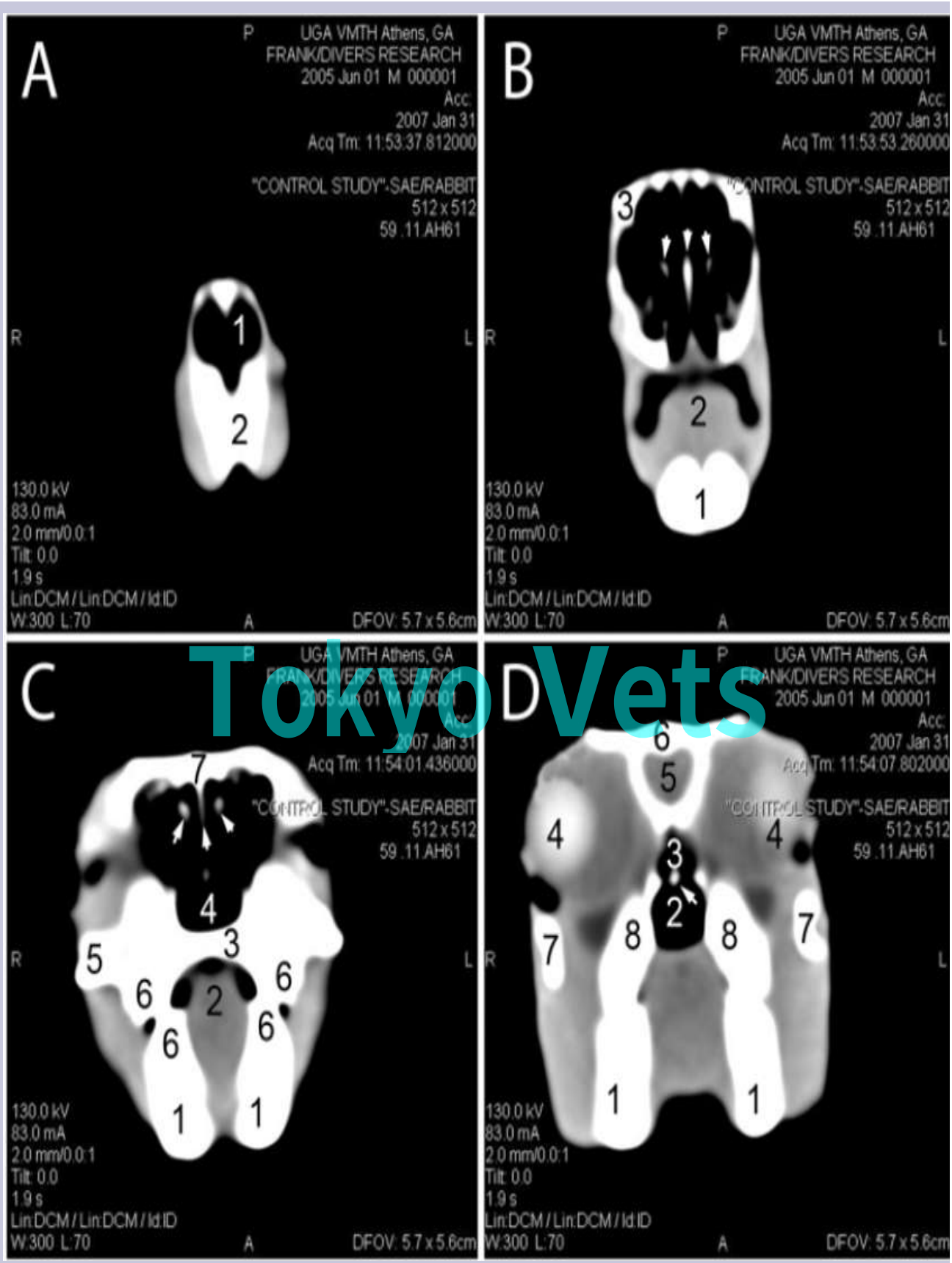

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CT of a normal rabbit. (A) Transverse plane image at the level of the upper incisors demonstrating the rostral

rhinarium (1) and upper incisors (2). (B) Transverse plane image at the level of the mid-diastema demonstrating the two mandibular rami (1), tongue (2), and maxilla (3), containing the midline vomer bone and turbinates structures (arrows). (C) Transverse plane image at the level of the 1st molar teeth demonstrating the mandible (1), tongue (2), hard palate (3), nasopharynx (4), ethmoid bone and endoturbinates (arrows), maxilla and zygomatic arch (5), 1st molars (6) and nasal bone (7). (D) Transverse cross-sectional slice at the level of the orbits demonstrating the mandible (1), oropharynx (2), nasopharynx (3), orbits (4), olfactory bulb of brain (5), frontal bone (6), zygomatic arches (7), perpendicular plates (8), and presphenoid bone (arrow).

Figure 6

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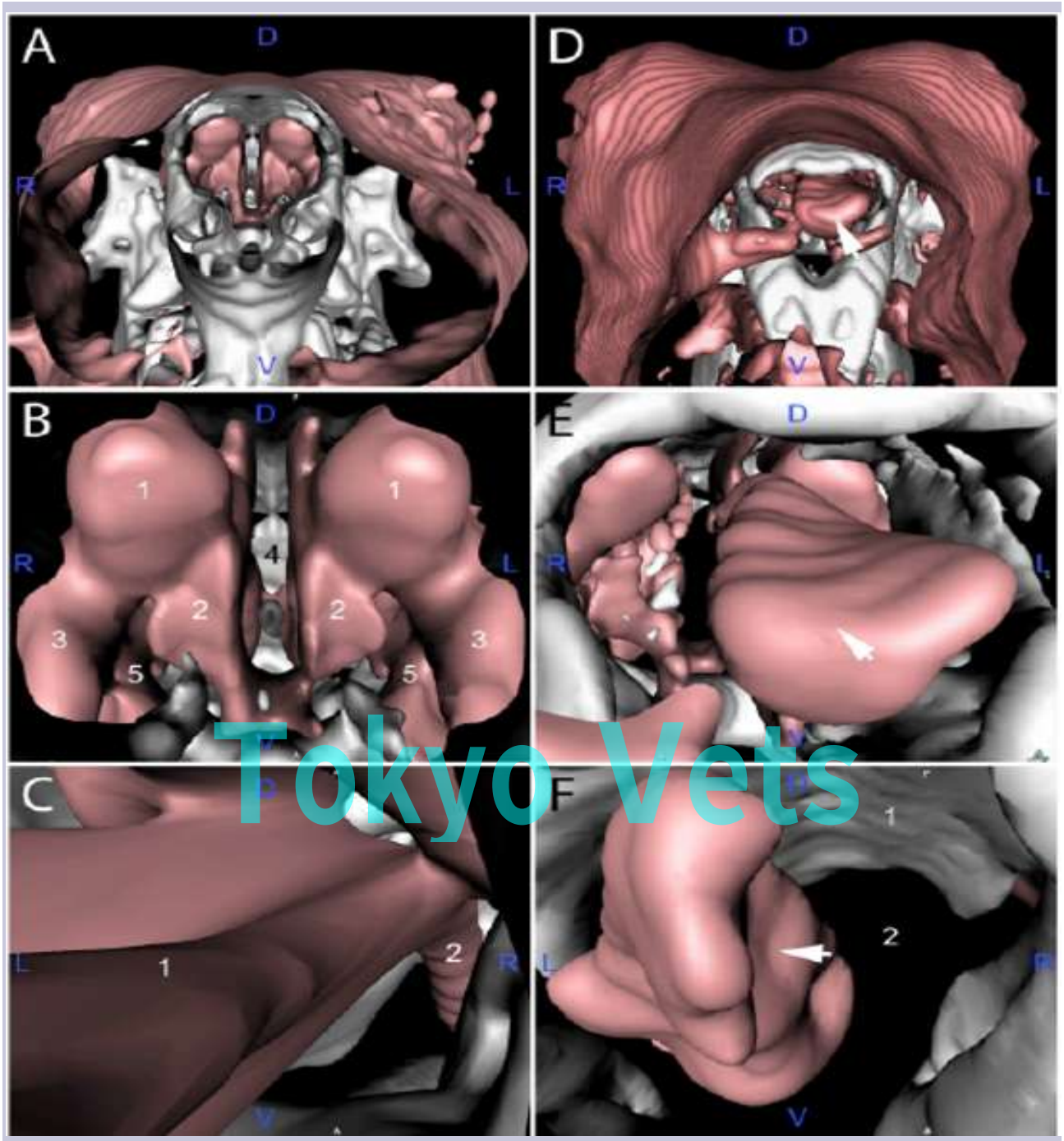

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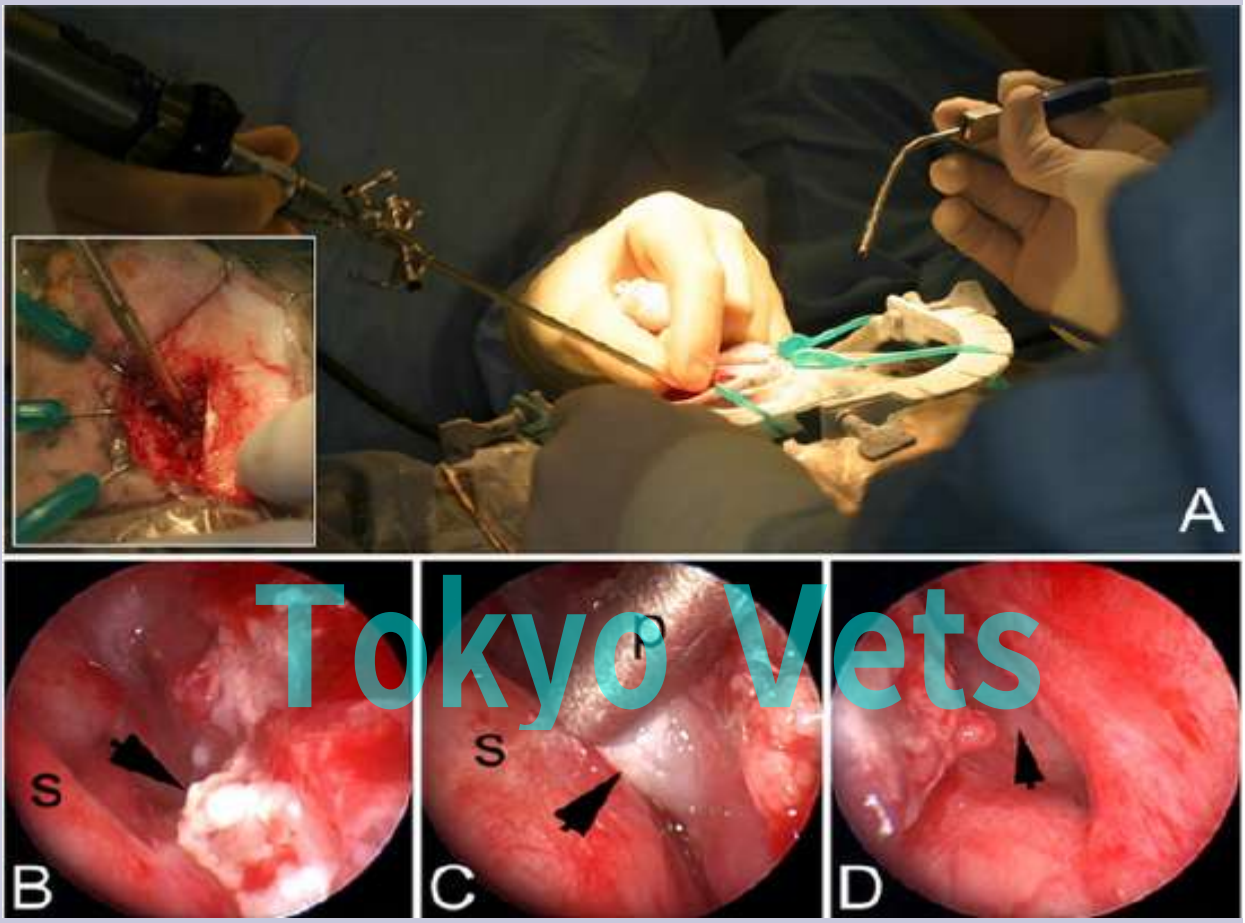
CT of the nasal cavity of two rabbits; normal control animal (A–C) (performed under an IACUC permit) and a clinical case of nasal mycobacteriosis (D–F). (A) Rostrocaudal view of a normal rabbit demonstrating the opening to the nasal cavity. (B) Close-up demonstrating an air cast within the nasal cavity. The dorsal (1), medial (2) and ventral (3) meati are clearly visible while the vomer bone (4) and turbinates (5) have been digitally removed. (C) View of an air cast from within the caudal nasal cavity demonstrating the nasopharynx (1) continuous with the trachea (2). (D) Rostrocaudal view of a rabbit demonstrating an asymmetrical air cast within the nasal cavity (arrow) due to nasal mycobacteriosis. (E) Close-up rostrocaudal view of an air cast of the nasal cavity demonstrating the replacement of normal meati with a large asymmetrical cavity (arrow) due

to destruction of the vomer bone and turbinates. (F) Caudorostral view of the same area as seen from within the nasal cavity. The asymmetrical air space (arrow), ventral surface of the dorsal nasal bone (1) and the nostril openings (2) are visible.

Figure 7



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Maxillary dental abscess and rhinitis; (A) Intra-operative view illustrating the use of the telescope to examine the nasal cavity following rhinotomy. Insert, close-up; (B) Endoscopic view of caseous exudate (arrow) within the ventral nasal meatus following the debridement of chronically infected turbinates. The nasal septum (s) is labeled for orientation; (C) Exposure of the tooth (arrow) that has extended into the nasal cavity and caused the infection. The nasal septum (s) is labeled for orientation, and the suction probe (p) is also visible; (D) Intraoperative view following tooth extraction and flushing of the site, revealing a now clear and unhindered ventral nasal meatus leading to the nasopharynx (arrow).

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