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MORPHOLOGICAL AND HISTOLOGICAL FEATURES OF NASO-PALATINE DUCT OF INDIGENOUS BUFFALO (*BOS INDICUS*)

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ABSTRACT
Twelve heads of adult and healthy indigenous buffalo were used for this study. The NPD was bilateral, symmetrical tubes starting after bifurcation of common duct. Its length was (5.2±0.3) cm in male and (4.8±0.4) cm in female and (2.9±0.2) mm, (2.2±0.7) mm in diameter in male and female respectively. Common duct is originated from incisive papilla and bifurcated into two ducts (NPD & incisive canal). NPD was located dorsally with crescent shape extended caudally and obloquy throughout the palatine fissure to opens at the floor of vestibular portion of nasal cavity and surrounded with cartilaginous capsule, while the incisive canal was located ventrally and leads to vomeronasal organ. Histologically the incisive papilla had narrow elliptical lumen, while the common duct and nasopalatine duct had wide oval lumen; all were lined by keratinized stratified squamous epithelium rested on sub epithelial connective tissue that heavily invaded by sero-mucous glands of positive PAS stain especially at nasopalatine duct and incisive canal .

KEY WORDS: Nasopalatine duct (NPD); Vomernasal organ; Jacobson gland.

INTRODUCTION

The nasopalatine duct (NPD) is bilateral tube passes obliquely between the oral and nasal cavity (GETTY, 1975). In many animals the NPD pass through the incisive canal from the incisive papilla, up to the vestibular portion of the nasal cavity and providing direct communication between the oral and nasal cavity. By this communication the NPD serve to access the pheromones to the incisive canal then to the vomeronasal organ. The functional appearance of NPD represented by Flehmen reaction in ox and stallion (ESTES, 1972). In other animals like, rat, mice and rabbit, the NPD communicates the vomeronasal organ directly with outer environment (Taniguchi and Mochizuki, 1983; Uraih and Maronpot, 2000; Sano and Okano, 1995). This study was aimed to investigate the nasopalatine duct involving its oral and nasal opening in indigenous cattle, which represent the major way for pheromones communication with vomeronasal organ (Accessory olfactory system).

MATERAILS & METHODS

A twelve heads of adult and healthy indigenous buffalo were used for this study. The samples include six male and six female which were obtained from Baghdad slaughter house. For anatomical study, the position of NPD was detected by entranced of long polyethylene catheter (0.8mm in diameter) in the nasal opening of NPD at the vestibular portion of nasal cavity on the floor of nasal cavity and up to (4.6) cm distance from nostrils, which pass along the tube of NPD and exit at oral opening of NPD via the incisive papilla. The length of NPD was measured after the remove of NPD from its position. For histological study the specimens were fixed in 10% formalin solution for (7) days. After well fixation the specimens have processed upgrading with ethanol alcohol for paraffin section examination, then sectioned serially in frontal plane at (5-6) µm. The prepared sections were stained with the Hematoxylin and Eosin stain, Van Gisson stain, and Periodic acid –Schiff (PAS) stain (Bancroft and Marilyn, 2008).

RESULTS AND DISSCUSION

Morphologically

Many of studies have been described the NPD in different species included the human openings of NPD into outer environment, (Besli *et al.*, 2004) has been described the differences in shape and size of this opening, in human and referred for three types of NPD, also (Estudio sobre and Frecuencia, 2008) have been described the vomer nasal organ and its shape and openings in human, in animals (Kratzing, 1971) has been mentioned three types of NPD based on the shape of its opening, (oval, fissure, and elliptical shape), others described this opening in laboratory animals (Vaccarezza *et al*., 1981).The vomeronasal organ of the rat. J. Anat., 132: 167-185 in indigenous buffalo the present results revealed that; the NPD was a tube extending caudally and obliquely from bifurcation of common duct, the common duct has started from the incisive papilla and passed throughout the palatine fissure to open in the floor of vestibular portion of nasal cavity about (4.6) cm from the nostrils (figures 1& 2). The length of NPD was (5.2±0.3) cm in male, (4.8±0.4) cm in female and (2.9±0.2) mm, (2.2±0.7) mm in diameter in male and female respectively. After about (1) cm from incisive papilla the common duct was bifurcated into two ducts (upper and lower ducts): the upper was crescent shaped and wide which represented the starting of NPD, while the lower was narrow which represented the starting of the incisive canal that leads into

the vomeronasal organ (figure1). The NPD was bent laterally to pass throughout the incisive fissure and open at the floor of vestibular portion of nasal cavity (figures 1&3). The common duct was incompletely surrounded with cartilaginous capsule, while the NPD was surrounded completely with cartilaginous capsule (figures 4, 5 & 6), the present study revealed that, the NPD lead to the oral cavity throughout the incisive papilla and to the nasal cavity through its a fissure like opening in the vestibular portion of nasal cavity, such observation were recorded by Karimi *et al*.,(2007) in goat, Salazar *et al*., (2003) in pigs, while in horse (Okano *et al*., 1998) and in rat (Vaccarezza *et al*., 1981) have been mentioned for absence of NPD so, the rostral end of incisive canal opens directly to nasal cavity and was no connection between the nasal and oral cavity.

Histologically

The present results showed that the incisive papilla had narrow elliptical lumen while the common duct had narrow oval lumen; both were lined by keratinized stratified squamous epithelium which rested on dense collagenous connective tissue (figuer7). Before bifurcation of the common duct, their lumen becomes wide elongated horizontally and the sero-mucous glands appeared at the dorsal aspect of duct which opened into the lumen through epithelium that lost its keratinization (figure 8), such observations have been recorded by Vaccarezza *et al*., (1981) in rat, Sano and Okano, (1995) in canine, and Smith, *et al*., (2002) in humans and chimpanzees. The present results suggest that the sub epithelial glandular connective tissue is specialized epithelial modified to protect the inlet of vomeronasal organ thus provided excess amounts of sero-mucous secretion of neutral reaction that similar to the secretion of Jacobson's gland of vomeronasal organ. After the bifurcation and separation of the common duct into incisive canal and NPD, the epithelium had lost its keratinization and the sub epithelial connective tissue became heavily invaded with sero-mucous glands of PAS positive with appearance of solitary lymphocytic infiltration, while its lumen became widest than before its bifurcation (figures 9 &10), the present study revealed that in buffalo there is an exact anatomical relationship between the vomeronasal organ and the NPD, the vomeronasal organ is almost always filled with fluid and there is a pump-like structure containing numerous of sero-mucus glands and blood vessels which can engorged momently to increase the pressure within organ, consequently forcing out the fluids, diminishing the engorgement can draw the fluid back (Lledo *et al*., 2005). The NPD play the major role in this mechanism of pumping and back drawing of fluids containing sexual pheromones, because the diameter of NPD exceeds the incisive papilla orifice, that is clearly obvious during the phenomenon of flehmen which associated with stimulation of vomeronasal organ when the males scenting various olfactory stimuli. The present is concluded that the NPD may considered as an area of adaptation for transportation of substances carrying odoriferous molecules between vomeronasal organ and outer environment because of their nature neutral mucus secretion which support the secretion of Jacobson gland within vomeronasal organ, while the incisive papilla is just to balance the pressure within vomeronasal duct during pumping mechanism.

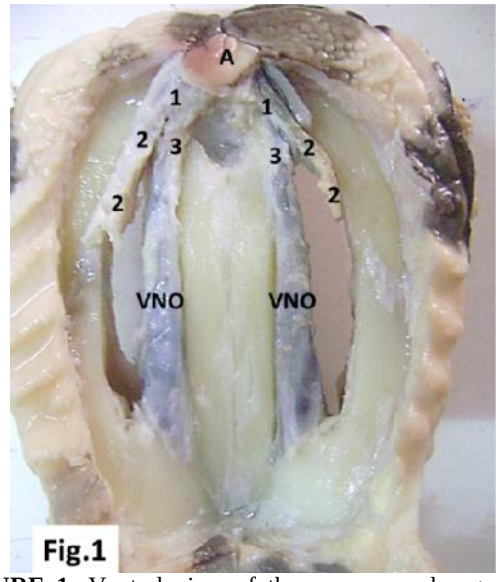


FIGURE 1: Ventral view of the vomeronasal organ and NPD .hard palate was removed completely to show: the common duct that started from incisive papilla (1), NPD (2), incisive canal (3), incisive papilla (A) and vomeronasal organ (VNO).

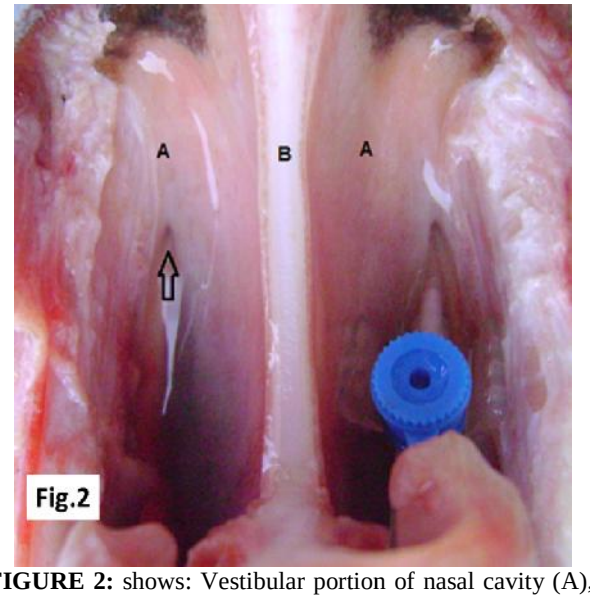


FIGURE 2: shows: Vestibular portion of nasal cavity (A), nasal septum (B) and arrow heads show the nasal opening of NPD.

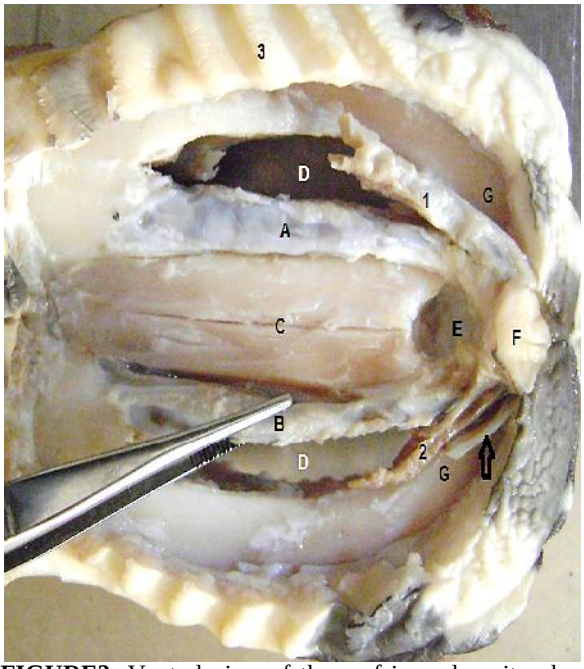
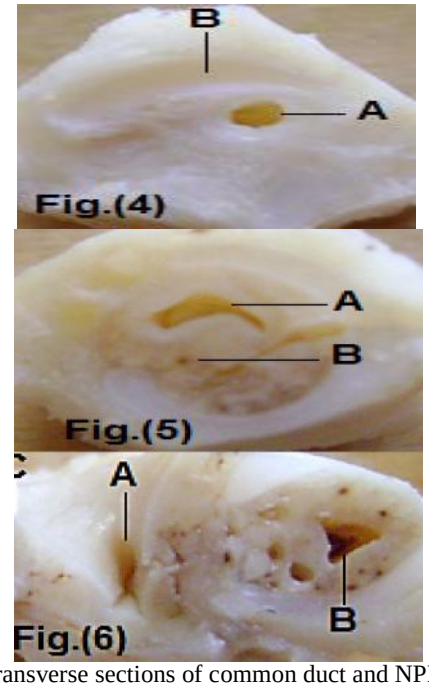


FIGURE3: Ventral view of the roof in oral cavity, .hard palate was removed completely show:
Right tube of vomeronasal organ (A), left tube of vomeronasal organ (B), incisive process of incisive bone (C), incisive fissure (D), inter incisive fissure (E), incisive papilla (F), body of incisive bone (G), right NPD (1), left NPD (2) and cartilage of common duct (arrow).



Transverse sections of common duct and NPD.

FIGURE 4: Common duct (A) and cartilaginous capsule (B).

FIGURE 5: bifurcation of common duct shows: NPD (A) and beginning of incisive canal (B).

FIGURE 6: final portion of NPD shows: Nasal opening of NPD (A), vomeronasal organ (B) & vestibular portion of nasal cavity represented deep groove housed the opening.

FIGURE 7: sections in the common duct shows: lumen of common duct (A), keratinized stratified squamous epithelium (B), hyaline cartilage (C), dense collagenous connective tissue (D) & keratin layer (Arrow). (van Gissons stain 40 x.

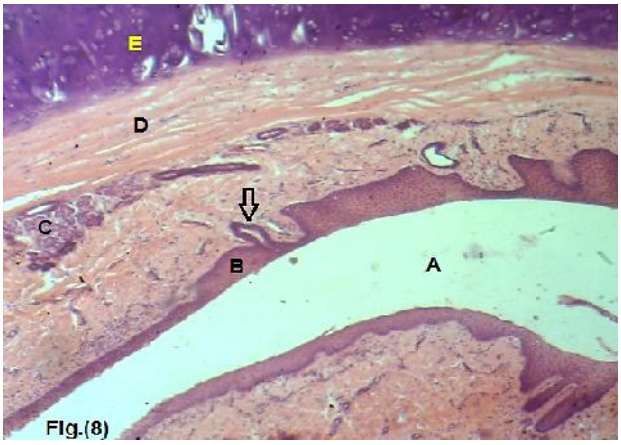
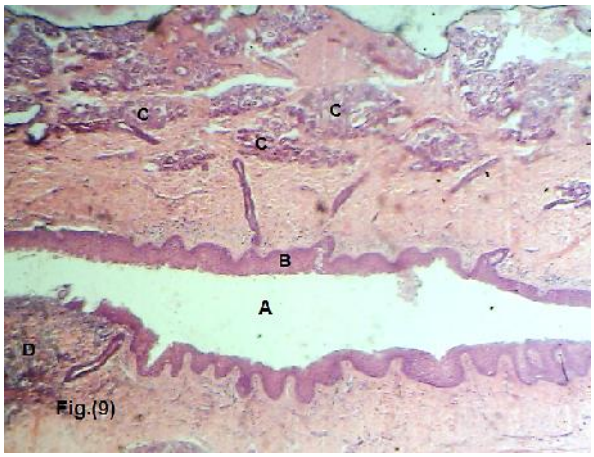


FIGURE 8: at level of bifurcation of common duct shows: lumen (A), epithelium (B), sero-mucus glands (C), perichondrium of cartilage (D), hyaline cartilage (E) (Arrow head shows a glandular duct opens at epithelium) (H&E) stain 40 x.



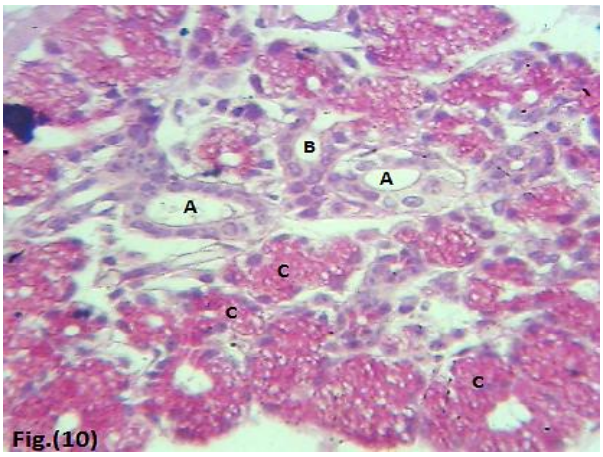


FIGURE 9: section in the NPD shows: Lumen (A), epithelium (B), sero-mucus glands (C), diffused lymphocytic infiltration (D). (H&E) stain 40 x.

Figure10: show sero-mucus acini of positive PAS stain with its duct system. Striated duct (A), intercalated duct (B) & sero-mucus acini (C). (PAS) stain 400x.

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