Comparative study of the auricle and external acoustic meatus of the
cattle and buffalo

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Abstract

The present work was designed to study the anatomical features and radiographic appearance of auricle and external acoustic meatus of cattle and buffalo, collected from (12) sample of heads were used in this study, there were equally divided into three groups: first group to study the shape, position and relation of cartilage, muscles and ligament of auricle in both animals, second group to study the measurements of external acoustic meatus, and the third group study morphological and radiographical of external acoustic meatus in both animal, the study revealed that the auricle is a flappy flashy appendage attached to the side of the skull by muscles and ligaments, the auricle is funnel shape, distally is wide open, but more proximally, it is rolled up to form a tube that bend medially to be connected to the external acoustic meatus, the auricle in both animals is composed of three cartilage: the part auricular, scutiform and annular cartilage also auricular muscle and ligament which support the external ear. The result of this study shows that intrinsic auricular muscles is more developed in buffalo, while the greater parts of the extrinsic auricular muscles are developed in both animals. The present work shows that the frontoauricular muscles are distinguish into two parts in buffalo and cattle on the other hand the interscutularis muscle thin fibers and attached with scutuloauricularis prefunds muscle in buffalo, also the parotidauriculares narrower and thicker in cattle, but a ribbon -like muscle thin and wide in buffalo. The external acoustic meatus begins where the rolled up part of the annular cartilage narrows and ends, the meatus has cartilaginous and osseous parts it is lined with skin the study provided that acoustic meatus about 5.667±0.0816 cm of length in cattle and 6.500±0.126 cm in buffalo, the aim of present work is to report more detailed information about the auricle and meatus in both animal for value importment can easily examined by the speculum the shortness of the meatus should be courses of the risk of injuring of the tympanic membrane and to be able to pass the otoscope tube through the external meatus and to recognize the eardrum when it is seen, to know the surgical anatomy of auricle and acoustic meatus and to know the relationship of vessels and nerve that must be avoid during surgery and to be able to recognize all parts of the temporal bone on radiographs.

Keywords: Auricle; External meatus; Cattle; Buffalo.
Introduction

The ear or organ of hearing and equilibrium is almost highly developed as the eye, the auricle which collects the sound waves together with the external acoustic meatus which conveys these waves to the tympanic membrane (1,2). The knowledge about the auricle and the external meatus can be help in medicine most often a response chronic inflammation for chronic proliferative otitis media, all the measurement done by using digital vernier calipers and tap, computerized statistical analysis was performed using the SPSS and the use of values reported, and ± SE, results were using T-test with p values less than (0.05) considered significant, less than (0.01) considered highly significant (6).

The others heads were used to the radiographic picture were performed in lateromedial (90°) and caudocranial (180°) direction, the values used were (85) KVP (14) m AS and (0.6) sec the morphological picture was fully described after examination of the films, the nomenclature used was adopted by Nomina Anatomica Veterinarinian (2005).

Results

If there is no any difference in the results between cattle and buffalo the results will illustrated under the name of both animal and if there is different between them will define in cattle and buffalo, the anatomical study of auriculares or (pinna) auricle as it is the stick out from the head composed of elastic cartilage covered with skin closely adherent and connected to the surrounding parts by muscles and ligaments, the auricle is inclined laterally the apex and middle part is much wider in buffalo than that cattle, the parts of the auricular cartilage determines the shape of pinna like lopsided funnel.

The margin of auricle (helix) is divided into two crura the medial is larger than lateral, the rostral border of the auricle is divided into two parts are approaches the ear opening (auricular concha) The medial part forms a prominent ridge on the inside of the ear cavity, the rolled
up auricular cartilage, the tragus is rectangular and separated from antitragus by antitragus notch, the anthelix in both animals is a transverse ridge on the concave (rostral) surface, the arrangements of the blood vessels and nerves are in associated with ridges on the concave surface.

The auricular cartilage is a funnel-shaped the outer part composed of elastic cartilage, bends toward the skull by annular cartilage through which the auricle attached to the external acoustic meatus.

The scutiform cartilage is a diamond plate in cattle and triangular plate in buffalo (Fig. 1,2) situated on the cranium with the a concave surface in contact with the fat and temporal muscle.

The annular cartilage is quadrilateral plate curved to form a ring and united by elastic tissue and rolled into short tube (Fig. 3,4) it connects the proximal end of the auricular cartilage to the acoustic meatus that forms the lower part of the auricular cartilage and the cartilaginous part of the external acoustic meatus.

The auricular muscles consists of two sets, the extrinsic which connect it with the skull and move the auricle as a whole and intrinsic which extends from one part of the auricle to another.

The extrinsic auricle muscles consist of:

**auriculars dorsales**

Interscutularis is a cutaneous muscle arises from the base of the corneal process and the frontal crest in both animals and is inserted to the medial part of the scutiform cartilage of the other side (Fig. 5).
Parieoaricularis it arises from temporal line and the nuchal ligament, where it inserts on the convex surface of the base of the auricular cartilage (Fig. 6).

**Auriculars ventrales**
Parotidouricularis is superficial muscle but it is narrow and thick in cattle a ribbon -like muscle, and it is thin and wide in buffalo (Fig. 7,8) it is origin from the parotid gland and inserted to the auricular cartilage.
Styloauricularis it is closely attached to the parotidoricularis in both animals it lies over the parotid gland and it is originate from styloid process inserted to the auricular cartilage (Fig. 7).

![Fig. 5: Shows 1- Interscutularis and 2-frontoauricularis muscle in buffalo.](image)

![Fig. 6: Shows parietoaricularis muscle in buffalo.](image)

Fig. 7: shows 1- styloauricularis, 2- parotidauricularis and 3- zygomaticoauricularis muscle in buffalo.

![Fig. 8: shows 1- parotidauricularis, 2- zygomaticoauriculatis and frontoauricularis muscle in cattle.](image)

Auricularis caudales
Cervicoscutlaris it lies nuchal ligament and inserts in the scutiform cartilage (Fig. 9).
Cervicoauricularis superficial in both animals well development muscle it is originated from the atlantal fascia inserts to the auricular cartilage (Fig. 10).
Cervicoauricularis medius is a small muscle which arise from the atlanto axial fascia insert to the auricular surface (Fig. 10).
Cervicoauriculars profundus can be distinguished into two parts both of which origin from occipital bone and insert in the caudal aspect of the auricular cartilage (Fig. 10).
Fig. 9: shows cervicoscutularis muscle in cattle.

Fig. 10: 1- cervicoauricularis superficial 2 - cervicoauricularis medius and 3- cervicoauricularis profundus in cattle.

**Auricularis rostrales**

Zygomatic auricularis is arises from zygomatic arch and is inserted to the lateral prominent of the auricular cartilage in common some of fibers fuse with scutiformauricularis (Fig. 7).

Scutiformauricularis superficial origin it is partly cover by interscutlaris, it is aspect of the auricular cartilage (Fig. 11).

Scutiformauricularis profundi it has two parts and both are well development the origin from deep surface of the scutiform cartilage and inserted to the auricularis cartilage (Fig. 12).

Frontoscutularis it has two parts (frontal and temporal) which arise from the zygomatic arch and temporal line and inserted in the rostral border of the scutiform cartilage (Fig. 7).

Fig. 11: 1-scutuloform auriculars covered with 2- interscutuloform in buffalo.

Fig. 12: 1- scutuloform auriculars superficial and 2- scutuloform auriculars profundus in buffalo.

The intrinsic auricle muscle consist of three muscles; Antitragicus is a short and thin fan shaped, band of the two border between auricle and annular cartilage (Fig. 13). Helicis the smallest of three it lies on the cranial border of auricle cartilage and curve backward below the annular ligament (Fig. 13). Transverses and oblige auriculares consist of two or three fleshy parts, they are covered by the insertion of the cervicoauricular superficial (Fig. 14).

The ligament of the auricle consist of the extrinsic connecting it to the side of the skull and intrinsic connecting various part of its cartilage together.

The extrinsic and intrinsic are two in number (cranial and caudal) the cranial extrinsic ligament extend from the
antitragus to the zygomatic process while the caudal extrinsic ligament passes from the concha to the mastoid process (Fig. 15).

Fig. 13: 1- antitragi’s and 2- helices muscle in buffalo.

Fig. 14: 1- transverse auriculars and 2- oblique auriculars muscle in buffalo.

The cranial intrinsic ligament are strong fibers bounded the scutiform and auricle cartilage, the caudal intrinsic ligament encircling the boundary of the concha.

Eternal acoustic meatus (Meatus caustic externa) or ear canal is the tube extend from the concha (ear opening) to the tympanic membrane it is formed by cartilage portion and osseous portion, it is the large opening caudal to the zygomatic arch where the external ear attaches, in life its cover by ear drum, it forms the rest of the meatus and is formed by the temporal bone (Fig. 16,17) the meatus in buffalo is oval in shape and about (6.500±0.0816) cm. while in cattle is circular in shape about (5.667 ±0.126) cm., data presented in table (1,2) show the length and diameter of the a caustic meatus in both animals, the present data show that the average length and diameters of a caustic meatus in buffalo more than in cattle.

Fig. 15: extrinsic auricular ligament in cattle.

Fig. 16: external acoustic meatus in buffalo.

The most commonly occurred radiological findings (Fig. 18,19) the external a caustic meatus were straight in both animals the external a caustic meatus is first directed ventrally and then rostomedially, lined by skin it is supported by the rolled up part of the auricle cartilage. The meatus are related laterally and ventrally to the parotid gland and the facial nerve crosses the ventral surface of the a caustic meatus deep to the gland (the parotid salivary gland which covers the proximal of the vertical portion of the external a caustic meatus), the
The facial nerve detaches a caudal auricular nerve and a branch to the interior of the a caustic meatus. The auricular muscles are innervated by the auricular branches of the facial nerve. The arteries lie more deeply the external carotid having detected the caudal auricular artery (Fig. 20). There are three arteries on the convex surface of the auricle, the medial, intermediate, and lateral auricle branches of the caudal auricular artery, maxillary, and superficial temporal arteries. The caudal auricular vein comes from the maxillary, it gives off lateral auricular and intermediate auricular vein in both animals.

![Fig. 17: external acoustic meatus in cattle.](image1)

Fig. 17: external acoustic meatus in cattle.

![Fig. 18: show the acoustic meatus in buffalo by x-ray.](image2)

Fig. 18: show the acoustic meatus in buffalo by x-ray.

![Fig. 19: shows the acoustic meatus in cattle by x-ray.](image3)

Fig. 19: shows the acoustic meatus in cattle by x-ray.

![Fig. 20: shows three branches of the caudal auricular artery in cattle.](image4)

Fig. 20: shows three branches of the caudal auricular artery in cattle.

Table 1: show the length and diameter/ cm of the a caustic meatus of the ear in cattle and buffalo.

<table>
<thead>
<tr>
<th>Samples (cm)</th>
<th>Cattle</th>
<th>Buffalo</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>length</td>
<td>diameter</td>
</tr>
<tr>
<td>1 Right ear</td>
<td>5.6</td>
<td>0.82</td>
</tr>
<tr>
<td>Left ear</td>
<td>5.7</td>
<td>0.79</td>
</tr>
<tr>
<td>Right ear</td>
<td>5.6</td>
<td>0.83</td>
</tr>
<tr>
<td>Left ear</td>
<td>5.6</td>
<td>0.83</td>
</tr>
<tr>
<td>Right ear</td>
<td>5.7</td>
<td>0.83</td>
</tr>
<tr>
<td>Left ear</td>
<td>5.6</td>
<td>0.84</td>
</tr>
<tr>
<td>Right ear</td>
<td>5.6</td>
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<tr>
<td>Left ear</td>
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<td>0.71</td>
</tr>
<tr>
<td>Right ear</td>
<td>5.6</td>
<td>0.83</td>
</tr>
<tr>
<td>Left ear</td>
<td>5.6</td>
<td>0.82</td>
</tr>
<tr>
<td>Right ear</td>
<td>5.7</td>
<td>0.85</td>
</tr>
<tr>
<td>Left ear</td>
<td>5.6</td>
<td>0.86</td>
</tr>
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</table>
Table 2: show the mean ± SD with T –test of length and diameter of the a caustic meatus of the ear in cattle and buffalo at P= 0.001.

<table>
<thead>
<tr>
<th>Group name</th>
<th>Mean</th>
<th>SD</th>
<th>T. test</th>
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</thead>
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<tr>
<td>length of the a caustic meatus in cattle</td>
<td>5.667</td>
<td>0.0816</td>
<td>0.494</td>
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<tr>
<td>length of the a caustic meatus in buffalo</td>
<td>6.500</td>
<td>0.126</td>
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<tr>
<td>diameter of the a caustic meatus in cattle</td>
<td>0.828</td>
<td>0.0 323</td>
<td>0.516</td>
</tr>
<tr>
<td>Diameter of the a caustic meatus in buffalo</td>
<td>1.150</td>
<td>0.0224</td>
<td></td>
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</tbody>
</table>

Discussion

The present work in both animals showed that the margin of auricle (helix) divided into two crura of which medial larger than lateral, the rostral border of auricle divides into two parts as it approaches the ear opening (auricular conchae), the medial part forms a prominent ridge on the inside of the ear cavity, the rolled up auricular cartilage the tragus and antitragus, the tragus is rectangular and separated from antitragus by antitragus notch the anthlix in both animals is a transverse ridge on the concave surface similar finding was observed by (8) in ruminant.

This work it has been demonstrated that the basal part of the auricular cartilage is coiled so as to form a tube which encloses the cavity of the concha and the annular cartilage curved to form about three-four of a ring similar observation were reported by (9) who showed that external acoustic meatus consist of two structure different parts cartilagineus and osseous. Some authors (10,11) have described the annular cartilage in cattle, sheep and goat while non described by (12).

The origin and insertion of the parotid auricularis and styloauricularis are fused therefore the styloauricularis appears to be absent morphology similar results were also report by (13) frontoscutularis it has two parts (frontal and temporal) which is mention by the present result, was not observed by (13). In our results found the interscutularis is well developed muscle in cattle and buffalo, however (13) observed that this muscle distinct in the ox.

The present work revealed that the external acoustic meatus is short in length and striated while in sheep, goat and dog is curved (8) According to the length and diameter of external acoustic meatus in buffalo more than in cattle, the measurements were not reported by any of the above mentioned authors in any of the domestic animals, the acoustic meatus are long due to the external ear in domestic mammals varies greatly in size and shape between species and on the other hand the arrangement of the intrinsic muscle that observed by present study similar to that is reported by (13).

The major structure to be avoided are the parotid salivary gland which covers the proximal one third of the vertical portion of the canal (8), otitis externa and calcification of the ear canal are most common ear diseases in veterinary practice and it is essential to identify diagnosis of that disease by radiographic is of value in some case to determined the extent of disease (14).

References