

Original Research Article

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## Histological Features of the Renal Arteries in Indian Goat (*Capra hircus*)

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### ABSTRACT

#### Keywords

Renal artery, Goat

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Histological features of renal arteries of goat revealed a typical muscular artery structure with three layers within outwards *viz.*, tunica intima, media and adventitia. Abundant sub-endothelial connective tissue was limited by clear undulating internal elastic membrane. Tunica media in all three renal arterial segments *i.e.*, proximal, middle and distal from aorta to the renal hilus was thicker. More than thirty rows of smooth muscle cells were arranged in circular fashion in tunica media. Their outer boundary was limited by fragmented thin wavy outer elastic membrane. Tunica adventitia of renal arteries comprised predominantly collagen and few elastic fibres which encroached into margins of tunica media and formed a circular out line around longitudinal bundles of smooth muscle. The outer elastic membrane was prominent coursing circularly in between layers of smooth muscle.

### Introduction

Arteries comprise three distinct layers *viz.*, tunica intima, media and adventitia whose structural proportion varied with the size and function of the particular artery.

Tunica intima of muscular artery consists of elongated flattened endothelial cells resting on areolar connective tissue. Increased amount of smooth muscle fibers with internal and external elastic membranes are seen in tunica media.

Tunica adventitia comprises collagen and elastic fibers predominantly and vasa vasorum. Small nutrient arteries and veins occur in the wall of larger vessels (Aughey

and Frey 2001 in mammals and Eurell *et al.*, 2006 in domestic animals).

Fewer strands of elastic fibers are seen in tunica media. Inner and outer layer of smooth muscle are arranged longitudinally and circularly in renal artery. Longitudinally oriented smooth muscle is present in the tunica intima between the endothelium and internal elastic membrane (Bacha and Bacha, 2000 in dogs and cats respectively).

Transition from elastic to muscular arteries may either be gradual or abrupt and the site of transitional zone for each vessel varied among species and individual animals (Eurell *et al.*, 2006 in domestic animals) and in dogs by Nowrozani and Asmarian (2014).

## Materials and Methods

Renal artery samples were collected from twelve adult apparently healthy goats along with kidneys, part of aorta, venacava and ureter. Tissue samples of right and left renal arteries of goats were taken from all specimens at three places of the main trunk viz., one closer to the aortic origin, other in the middle of its course and the third closer to the hilus of kidney. Samples were preserved in 10% NBF solution and later were processed for routine paraffin method (Singh and Sulochana, 1997). About 4-5 $\mu$ m thick paraffin sections were stained for routine H & E and other special staining techniques such as Mallory's triple stain method (Singh and Sulochana, 1997) and Verhoeff's stain for demonstration of elastic fibres (Culling 1974).

## Results and Discussion

In the present investigation all three renal arterial segments taken from proximal, middle and distal parts of main renal artery in goats on both sides revealed typical microscopic features of a muscular artery. The arterial wall consisted of three layers within outwards viz., tunica intima, tunica media and tunica adventitia respectively (Figs. 1 and 2). In all of the above specimens the tunica media consisted of relatively thick coat of smooth muscle cells mostly arranged in circular fashion, which is in concurrence with the description of muscular arteries by several authors (Vodenicharov and Cirnuchanov, 1995 in domestic swine; Dellmann and Eurell, 1998 in domestic animals; Alessandro *et al.*, 2006 in swine; Gholami *et al.*, 2007 in sheep; Parchami *et al.*, 2009 in sheep and goat; Norouzani *et al.*, 2008 in cats, Nowrozani, 2010 and 2011; Nowrozani *et al.*, 2012 and Nowrozani and Asmarian, 2014 in dogs). Content of elastic fibres in tunica media was negligible in the goat and pig renal arteries studied.

The intima of renal artery in goats was lined by single layer of endothelial cells attached closely to underlying connective tissue and limited by wavy internal elastic membrane (IEM). Undulations of IEM resulted in its protrusion into smooth muscle enriched tunica media (Fig. 3), thin continuous wavy line above which negligible amounts of sub-endothelial connective tissue was seen. These observations are in agreement with the findings of Vaish *et al.*, (2003) in adult goats, Alessandro *et al.*, (2006) in pigs and Gholami and Haghghat (2007) in post natal sheep. They further mentioned that sub-endothelial connective tissue was minimal or almost absent in these animals.

In three segments sub-endothelial connective tissue of renal artery was quite thick over a translucent IEM and comprised few collagen and elastic fibres between which some smooth muscle nuclei were observed (Fig. 4), IEM was moderately thick solid wavy structure limiting tunica intima and was continuous in all three segments in goats (Fig. 5) and they were filled up with packed collagen fibres and few smooth muscle cells.

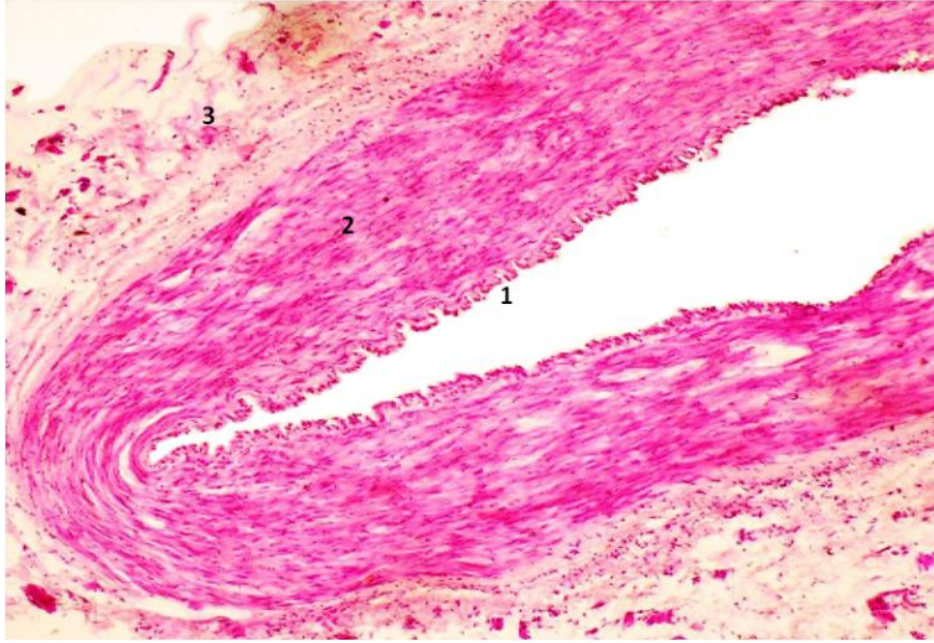
Similar 'tufts' like structure was reported in domestic swine by Vodenicharov and Cirnuchanov (1995) who stated that internal elastic membrane was wrinkled with higher and wider curves between which longitudinally oriented smooth muscle cells forming 'tufts' were seen.

In the present study the tunica media was populated by more than 30 rows of smooth muscle cells oriented circularly. Its outer boundary was limited by fragmented thin wavy outer elastic membrane beyond which was the tunica media (Fig. 6). Similar reports were made in swine by Vodenicharov and Cirnuchanov (1995) and Alessandro *et al.*, (2006) and Trautmann and Fiebiger (2002) in domestic animals.

**Fig.1** Photomicrograph of proximal segment of right renal artery of goat showing three layers namely tunica intima, media and adventitia

(H & E stain - 4x)

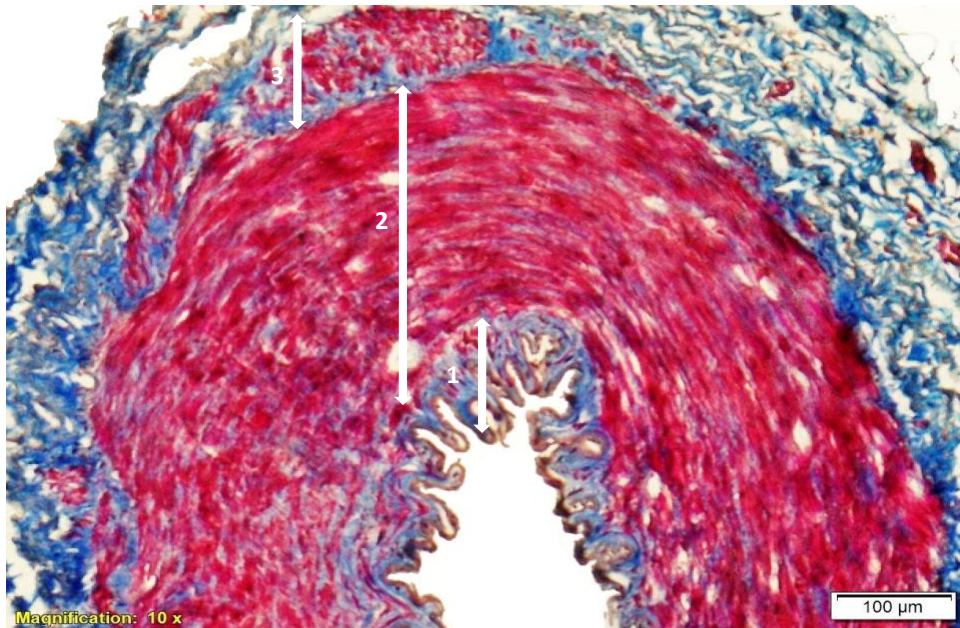
- 1 – Tunica intima
- 2 – Tunica media
- 3 – Tunica adventitia



**Fig.2** Photomicrograph of distal segment of left renal artery of goat showing three layers

(Mallorys triple stain –10x)

- 1 – Tunica intima
- 2 – Tunica media
- 3 – Tunica adventitia

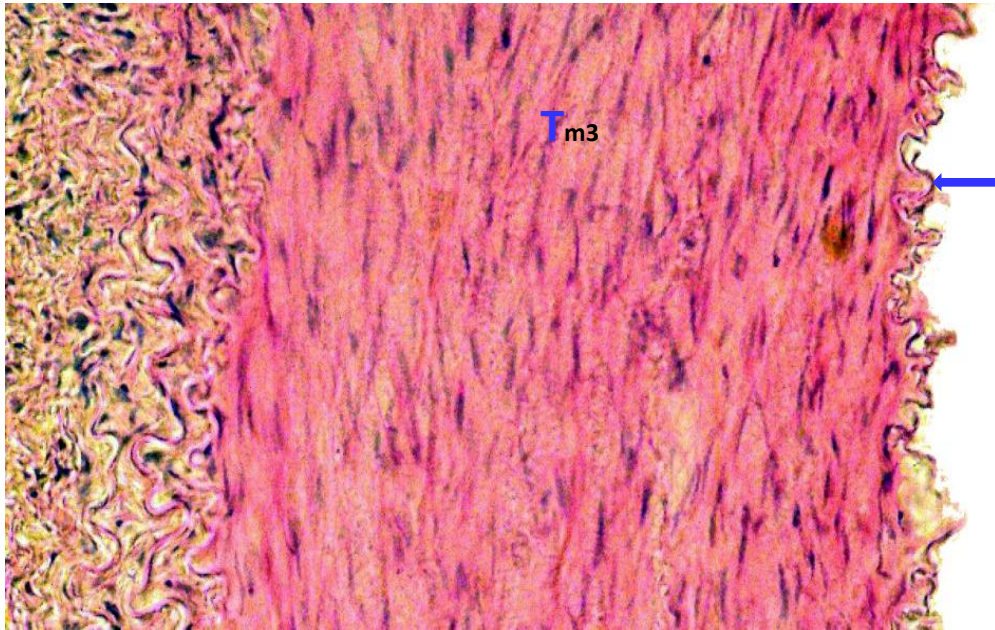


**Fig.3** Photomicrograph of middle segment of Right renal artery of goat showing smooth muscle fibers in tunica media

(H&E – 16x)

→ Internal elastic membrane

Tm – Tunica media

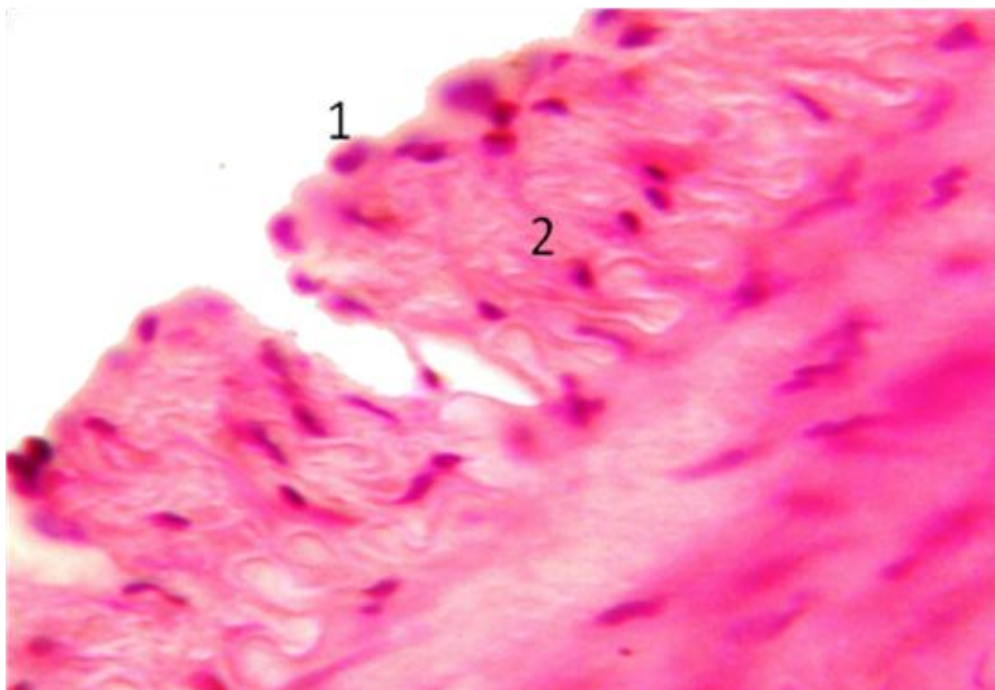


**Fig.4** Photomicrograph of proximal segment of right renal artery of goat showing subendothelial connective tissue in tunica intima

(H&E – 40x)

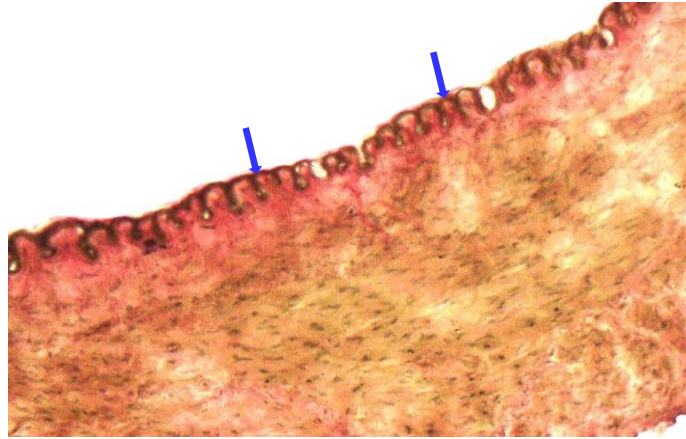
1 - Endothelium

2 - Subendothelial connective tissue



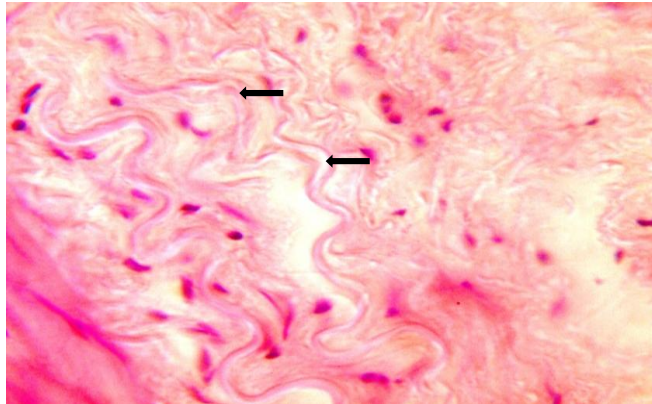
**Fig.5** Photomicrograph of proximal segment of right renal artery of goat showing internal elastic membrane (→)

(Verhoeffs stain – 16x)



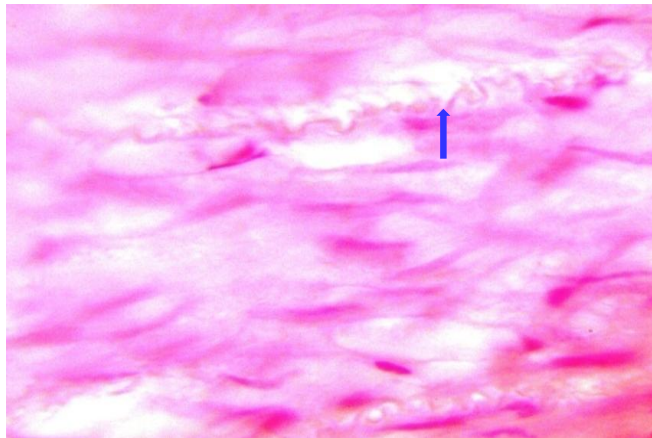
**Fig.6** Photomicrograph of proximal segment of left renal artery of goat showing elastic fibers (→) in tunica adventitia

(H&E – 40x)



**Fig.7** Photomicrograph of distal segment right renal artery of goat showing wavy elastic fibers (→) in tunica media

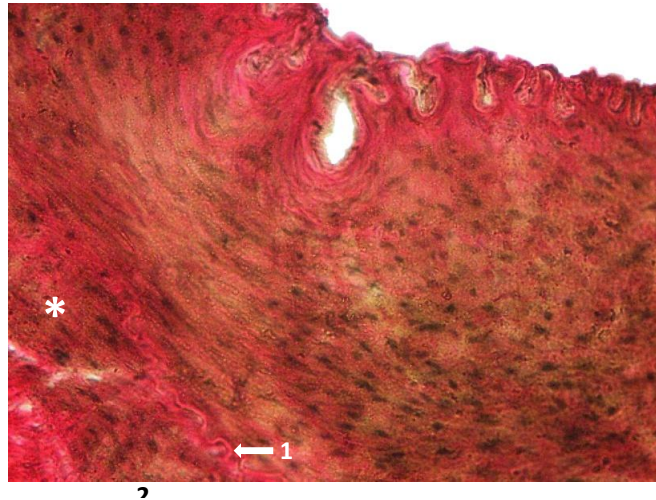
(H&E stain – 40x)



**Fig.8** Photomicrograph of distal segment of right renal artery of goat showing outer connective tissue fibers enchroching the tunica media around the longitudinal bundles of smooth muscle fibers

(Verhoeffs stain – 20x)

- \*- Smooth muscle bundles
- 1 – Outer elastic laminae



Immediately next to it were smooth wavy strands of elastic fibres located between connective tissue in adventitia (Fig. 6). Solitary wavy elastic fibres were seen in media on its outer side (Fig. 7). Outer part of tunica media comprised translucent lines which were seen enveloping inwards around longitudinal smooth muscle bundles (Fig. 8)

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