

## VARIATION IN THE HISTOLOGICAL STRUCTURE OF ROUND LIGAMENT OF UTERUS AT UTERINE CORNU WITH AGE

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### ABSTRACT

**Introduction:** The aim of present study is to evaluate the microscopic structure of the round ligament of uterus at the uterine cornu to examine the changes in the structure in different age groups i.e. adult females in reproductive age group, pregnancy & menopause.

**Materials and Methods:** Twenty two round ligaments of uterus (25-70 yrs) were taken for the study of the microscopic structure at the uterine cornu. The specimens were collected from adult females of reproductive age group, pregnant females and menopausal females. Microscopic structure was studied under light microscope using haematoxylin and eosin and Van Gieson's stain was used to differentiate muscle from fibrous tissue.

**Results:** The round ligament showed changes at the two ends of age spectrum chosen for the study (25-70 yrs). In adult females of reproductive age group (25-40 yr old) it was predominantly muscular and the smooth muscle of the ligament was found to be continuous with that of the myometrium. In pregnant females marked hypertrophied smooth muscle bundles with increased collagen bundles and vascularity were seen. In menopausal age group, tendency towards fibrosis was seen and blood vessels were reduced in number.

**Conclusion:** Variations seen in the ligament in different age groups and continuation of the smooth muscle of the round ligament with the myometrium at the uterine cornu may explain the role played by it in keeping the uterus in anteverted position. Role of the ligament would become clearer through a further study of microscopic structure of a larger sample size including different age groups.

**KEY WORDS:** Round ligament, Uterus, Histology.

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Access this Article online	Journal Information
<b>Quick Response code</b>  DOI: 10.16965/ijar.2017.531	<b>International Journal of Anatomy and Research</b> ICV for 2016 90.30 ISSN (E) 2321-4287   ISSN (P) 2321-8967 <a href="https://www.ijmhr.org/ijar.htm">https://www.ijmhr.org/ijar.htm</a> DOI-Prefix: <a href="https://dx.doi.org/10.16965/ijar">https://dx.doi.org/10.16965/ijar</a> 
	Article Information
	Received: 17 Dec 2017 Peer Review: 18 Dec 2017 Revised: None
	Accepted: 02 Feb 2018 Published (O): 05 Mar 2018 Published (P): 05 Mar 2018

### INTRODUCTION

The round ligament of uterus represents a mammalian developmental novelty. The unusual structure of the round ligament is related to one or more of the many unusual features of human uterine development. The uterus develops as a single organ with a position deep in the abdominal cavity below the pelvic brim and far away

from the posterior abdominal wall. The unusual anatomical position may require an unusual construction of the uterine suspensory apparatus of which the round ligament is one component [1]. Its exact role in females has many claims. In the 19<sup>th</sup> century great stress was put upon the role of the round ligaments in holding the uterus in a forward position [2]. The role of the

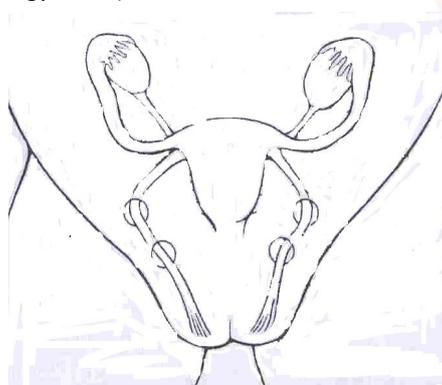
round ligament as a supporting structure for the non pregnant uterus has become less acceptable in more recent decades. However, any laxity to the ligament leads to a “floppy uterus”. This will show up as an anteverted uterus on one pelvic examination and as a retroverted uterus on the next examination [3]. However, few workers in the past have investigated these ligaments in the adult human females [4-10]. The obtained views indicate that they may directly contribute to the normal activity of the female reproductive tract. Knowledge of the detailed histology would be of value in the understanding of its physiological role.

**Aim:** To study the microscopic structure of the round ligament of uterus at the uterine cornu to examine the changes in the structure in different age groups i.e. Adult females in reproductive age group, pregnancy & menopause.

#### MATERIALS AND METHODS

18 female cadavers (25-70 yrs) were utilized for the study of round ligament of uterus. Out of this, material was taken from 12 adult non pregnant women in the reproductive age group and 6 were post menopausal women. In pregnant women (4), the round ligament was taken from uterus during operation of Caesarian section (abdominal hysterectomy). The proximal stump of round ligament close to uterotubal junction attached at the uterine cornu was utilized for tissue processing and histology (Fig. 1).

**Fig. 1:** Schematic diagram of coronal section of adult uterus to show the site from where the sections of the ligament were taken (after Larsen, Textbook of Embryology, 2001).



A part of the uterine cornu was also included in the samples of the ligament. To study the microscopic structure of the round ligament at the uterine cornu, each round ligament was cut

transversely and cut parts were subjected to tissue processing for histological study. The specimens were dehydrated in ascending grades of alcohol, cleared in chloroform and embedded in paraffin wax. 5 $\mu$  thick sections were cut and were examined with H & E and Van Gieson's stain was used to differentiate muscle from fibrous tissue.

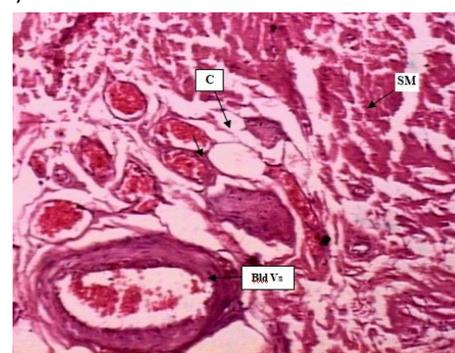
#### RESULTS

In the present study, the round ligament of adult females were studied at the uterine cornu (Table 1). In the adult females during reproductive age group, round ligament is found to be predominantly muscular having smooth muscle cells. The smooth muscle of the ligament is continuous with the myometrium of the uterus which is in agreement with the findings of Schäfer, Symington and Bryce(1914) [14], Bunim (1921) [15], Hendricks and Moawad (1965) [9], McVay(1984) [16], Pernoll et al (1987) [17]and Van der Schoot (1996) [1](Fig. 2,3 &4). Collagen and elastic fibres are present in between the muscle fibres. In three out of the eight specimens, a central vascular core is seen which is in concurrence with the study conducted by Musgrove et al (1978) [18].

In menopause, the round ligament shows a core of blood vessels with smooth muscle, collagen and elastic fibres at periphery. Smooth muscle fibres are few and scattered but not compact and are seen interspersed with connective tissue that is increased due to fibrosis (Fig. 5,6 ). No areas of hyaline degeneration are seen.

The round ligament in pregnancy shows marked muscle hypertrophy with abundant connective tissue and blood vessels (Fig.7 ).These findings are similar to those of Maher Mahran (1965) [11].

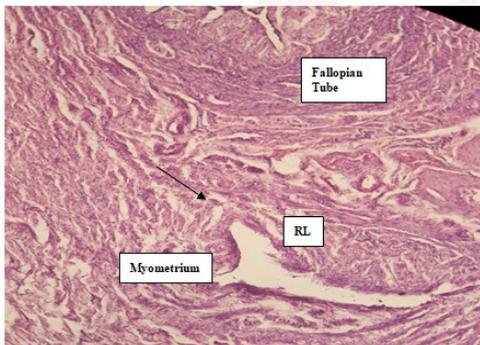
**Fig. 2:** (X10) TS through the RL at uterine cornu in an adult female of reproductive age showing smooth muscle bundles (SM) with collagen(C) in between, vascularity (Bld Vs) is also increased.



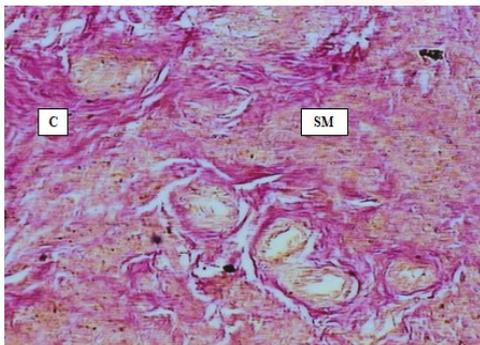
**Table 1:** Microscopic structure of adult round ligament at Uterine cornu.

	Blood vessels	Smooth muscle fibres	Collagen fibres	Elastic fibres	Fat
25yrs	++	+	+	+	+
25yrs	++	+in TS	+ at periphery	+	-
25yrs	++	+ in different directions	+ in centre	+	-
30yrs	++	+ in centre	+ more at periphery	+	-
30yrs	+ in centre	+ in periphery	+ few	+few	-
35yrs x2	++	+	+	+	+
35yrs	+in centre	+ at periphery	+ more at periphery	+	-
40yrsx4	+in centre	+ in bundles	+ at periphery, few in centre.	+	-
70yrs x4	+in centre	+ in TS , not compact	++	+	-
70yrs x2	+	+ in TS	++	-	-
Preg x 4	++	+ thick	++	-	-

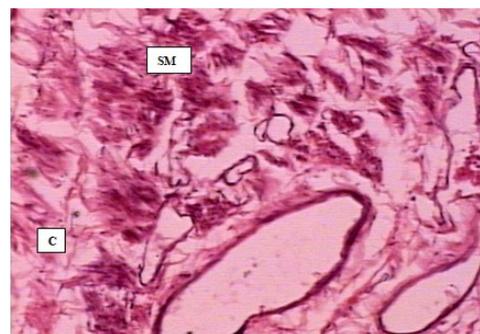
**Fig. 3:** (X10) Depicting the continuity of smooth muscle of RL with the myometrium in another specimen.



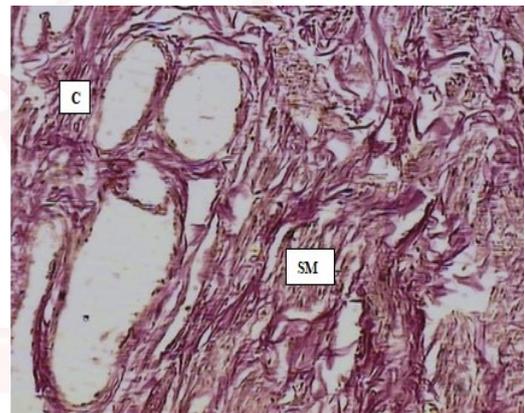
**Fig. 4:** (X20) TS through the RL in an adult female of reproductive age. Van Gieson's stain done to differentiate smooth muscle from collagen from another specimen.



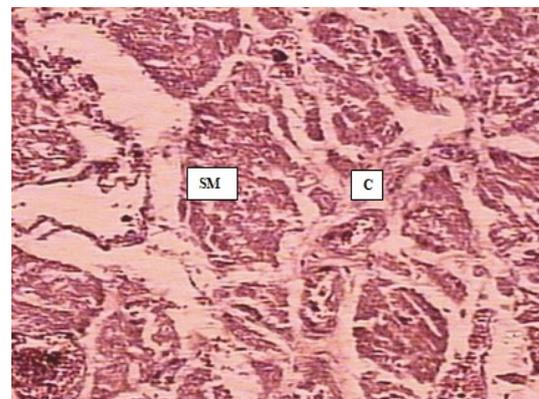
**Fig. 5:** (X10) TS through the RL at uterine cornu in a menopausal female showing few scattered muscle bundles (SM) and plenty of collagen fibres (C).



**Fig. 6:** (X20) TS through the RL in a menopausal female. Van Gieson's stain shows predominance of collagen fibres (C) but very few smooth muscle fibres (SM) are seen.



**Fig. 7:** (X10) TS through the RL at uterine cornu in a pregnant female showing hypertrophied smooth muscle fibres (SM) with abundant collagen (C).



## DISCUSSION

The microscopic structure of adult round ligament has been described in a number of textbooks. Keeping in view the more generally accepted views and the discrepant claims of

many workers an attempt has been made to study the difference in its structure at the uterine cornu in different age groups and compare them with the available literature. The adult round ligament is a muscular structure. The muscle fibres are arranged in two layers. The central thick core is of longitudinal bundle of non striated muscle fibres while the peripheral layer of fibres run obliquely. It is poor in elastic fibres and richly supplied by nerve fibres. The structure shows variations at different stages of life. Since the round ligament contains insignificant amount of elastic tissue and its activity is purely muscular it deserves to be called the round muscle [11]. Copeland (2000) [12] mentions that the round ligament is composed mostly of fibrous tissue with a small admixture of smooth muscle.

Testut (1901) [13] claimed that the round ligament is mainly formed of smooth muscle tissue and so it should be called as the round muscle. Schäfer, Symington and Bryce (1914) [14], Bunim (1921) [15], Hendricks and Moawad (1965) [9], McVay (1984) [16], Pernoll et al (1987) [17] and Van der Schoot (1996) [1] described that the proximal portion of round ligament had smooth muscle which were anatomically continuous with smooth muscle of uterus. Besides this, it also contained certain amount of connective tissue, small blood vessels, nerves and lymphatics.

**Musgrove et al (1978) [18]** studied the microscopic structure of the round ligament in rat and guinea pig and found it to be made up of longitudinally oriented smooth muscle bundles surrounding a connective tissue core. The smooth muscles were separated from myometrium by collagen except at tubo-uterine junction where it extended to become continuous with outer layer of myometrium.

**Maher Mahran (1965) [11]** studied the structure of the ligament in different age groups in great detail:

a) Round ligament in adult non pregnant females during reproductive period was formed of mainly non striated muscle fibres, grouped in bundles, separated from each other by fibrous tissue septa. The connective tissue between muscle bundles consisted of collagen fibres, fibroblasts, embryonic connective tissue cells with macrophages and mast cells. Plenty of

blood vessels (zig zag in LS) were seen. Transverse section revealed muscle fibres arranged as central longitudinal core surrounded by peripheral thin layer of obliquely or longitudinally running fibres. Special stains revealed that fibrous tissue was predominantly collagen fibres, very few elastic fibres were seen. A rich network of nerve fibres was observed.

b) Round ligament in pregnant females showed muscle fibre hypertrophy. Bundles were thicker and better developed. Connective tissue was more abundant. There was loosening of muscle fibres. The same arrangement was present as in the non pregnant females during the reproductive period i.e. central longitudinal core with peripheral oblique fibres which cross each other. The ligament was more vascular.

c) Round ligament in menopausal females showed a reduction in the muscle tissue. The muscle bundles were thin and interrupted, crossing fibres disappeared but not the original pattern. Fibrous tissue was increased, cellular element decreased and areas of hyaline degeneration were seen. Blood vessels were thick walled with medial hypertrophy.

## CONCLUSION

The histological structure of the round ligament at the uterine cornu showed marked changes in the different age groups. Thorough check of histological and clinical data and their evaluation regarding the function of round ligament in pregnant uterus was done by Tarjan G, Bognar Z, 1979 [19]. It showed its possible role in the mechanism of labour. Changes of the round ligament were found to be correlated with the occurrence of various forms of labour insufficiency as well as of abnormal presentation and position. Such pathological conditions would be attributable to developmental anomalies of the round ligament, its instability, and cicatrisation following inflammations and surgery and resulting asymmetrical position of the uterus.

The pathological position of the round ligament would rule out spontaneous labour. The anatomical continuity of the smooth muscles of the ligament at the uterine cornu with the uterine myometrium can explain the role of the round ligament in labour. Symptomatic uterine retroversion in women with mild uterine descent but

without significant pelvic pathology was treated by combined laparoscopic uterosacral and round ligament procedures with modified Gilliam suspension. It was found to relieve chronic pelvic pain, dyspareunia and other symptoms caused by retrodisplacement. Long lasting results were obtained in suspending uterus in anteverted and anteflexed position [20].

Knowledge of the detailed histology of the round ligament of uterus is important in the understanding of its physiological role. The obtained views indicate that they may directly contribute to the normal activity of the female reproductive tract.

### ACKNOWLEDGEMENTS

Authors acknowledge the immense help received from the scholars whose articles are cited and included in references of this manuscript. The authors are also grateful to authors / editors / publishers of all those articles, journals and books from where the literature for this article has been reviewed and discussed.

**Conflicts of Interests: None**

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**How to cite this article:** Tripti Shrivastava, P. Vatsalaswamy, Sushil Kumar. VARIATION IN THE HISTOLOGICAL STRUCTURE OF ROUND LIGAMENT OF UTERUS AT UTERINE CORNU WITH AGE. *Int J Anat Res* 2018;6(1.3):4982-4986. DOI: 10.16965/ijar.2017.531