



## Pathological investigation of female reproductive system of cows in Rajshahi district of Bangladesh

Rashida Khaton<sup>1\*</sup>, Md Mokbul Hossain<sup>2</sup>, and Md Jalal Uddin Sarder<sup>1</sup>

<sup>1</sup>Department of Veterinary and Animal Sciences, Faculty of Veterinary and Animal Sciences, University of Rajshahi, Rajshahi-6205, Bangladesh

<sup>2</sup>Department of pathology, Faculty of Veterinary Science, Bangladesh Agricultural University, Mymensingh-2202

### Abstract

The present research work was undertaken to detect pathological disorders of female reproductive organs in cows based on examining gross and histopathological characters. A total of 115 female genital organs were randomly collected from eight (8) slaughter houses of Rajshahi district in Bangladesh. All samples were collected from the cows irrespective of ages, different body weight and genotypes. Grossly the entire reproductive system from vulva to ovary was examined for the presence of any detectable abnormalities. The representative samples were preserved in 10% neutral buffered formalin for histopathological examination. Among these samples, 73% samples showed gross pathological changes. The result showed that pathological conditions recorded grossly in the reproductive system were granular vulvo-vaginitis (9.57%), swollen and edematous cervix (10.43%), endometritis (19.14%), pyometra (5.21%), mucometra (2.61%), parasitic cyst within the uterus (0.87%), follicular cyst (9.57%), luteal cyst (2.61%), multicystic ovary (1.73%) and mesovarian cyst (0.87%). The relative incidences of various histopathological disorders were endometritis (30.36%), cervicitis (21.42%), vaginitis (23.21%), follicular cyst (17.87%) and multicystic ovary (7.14%). It is concluded that more than one disorder was existed in all sample. Finally, the monitoring of the reproductive health status of cows is helpful for making decision about treatment or culling of non-productive cows from the herd and also selection of good quality of dairy cows for increase calf and milk production which will be helpful to overcome losses due to reproductive disorders.

**Keywords:** Pathological disorders, genital organs, dairy cows, slaughter house, Rajshahi district

## INTRODUCTION

Livestock sector in Bangladesh alongside agriculture is considered as the backbone of Bangladesh economy (Ahmed *et al.*, 2013). It plays an important role in the rural economic and export trades of Bangladesh. Reproductive efficiency is an important facet for achieving maximum return from the animal. It has a major impact on economic success of any dairy production unit (Robert and Gilbert, 2016). But the production is hampered due to various reproductive diseases. The extent

to which reproductive wastage reduces production efficiency is not well documented, for example there is currently no information available regarding the proportion of cows having reproductive problems at the time of slaughter or the percentage of culling rate due to genital disorders. Generally female animals are culled and sent to slaughter houses either because they are uneconomical to maintain or else because they have disease problem. Hence, local slaughter houses could serve as a good source for studying pathological condition of the

\*Corresponding author's E-mail address: [rashidavet@yahoo.com](mailto:rashidavet@yahoo.com)

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reproductive organs of the cow. This study could be of value to understand the causes of sub-fertility, infertility or even sterility to some extent (Thrusfield, 1995). In cattle, the infectious diseases in reproductive organs as pyometra, metritis and endometritis etc. in long standing cases cause infertility (Roy, 2001).

There is no alternate of fertility, however reproductive disorders cause various problems ultimately leading to substantial economic losses through failure to produce or delay in producing the animal life calf, that lead to increased calving intervals and culling of useful breeding animal. It has also a negative effect on efficient milk production since pregnancy and parturition are prerequisite for the initiation and maintenance of lactation. It is generally assumed that sub-fertility is a major problem of dairy cows than the beef cattle (Arthur *et al.*, 1998). One of the major constraints of profitable dairy farming is low pregnancy rate (Shamsuddin *et al.*, 2001) and this low pregnancy rate is mainly due to different pathological disorders in reproductive system of cows. Postpartum diseases are common in dairy cows, and their incidence contributes to reduced fertility and increased risk of culling (Robert and Gilbert, 2016). Reproductive disorders create a remarkable economic loss to the farmers. The common gynaecological problems leading to pregnancy failure are cystic ovary, retained fetal membrane (Shamsuddin *et al.*, 1988), uterine infection, cervicitis and vaginitis (Youngquist, 1985). Considerable studies have been conducted on reproductive tract abnormalities of cows in many countries of the world and reported several abnormalities with different prevalence rates (Timurkaan and Karadas, 2000; Saxena *et al.*, 2006).

Specific and non-specific infectious agents during pre- and post-partum periods frequently invade the reproductive organs and produce various diseases. Bacterial infection is the most important among the various causes of the sub-fertility (Dholakia *et al.*, 1987). Such a condition may cause cervicitis or endometritis of various degrees, which in turn may lead to embryonic death and repeat breeding problems (Elliott *et al.*, 1968). Histopathological study of reproductive organs after slaughtering is known to be of paramount importance in the diagnosis and prognosis of the infection.

It is accepted that bovine genital infections, either specific or non-specific in nature, account for large number of pregnancy failure in cows. Generally non-specific infection of the genitalia is considered to be the main cause of repeated conception failure (Singh *et al.*, 1996). Poor reproductive performances, a greatest economic treat, are often associated with failure in con-

ception, infertility, embryonic deaths and abortion, and other gynecological disorders (Talukder *et al.*, 2005). It is particularly widespread among dairy cattle which are most valuable (Arthur *et al.*, 1998). The incidence of endometritis has increased menacingly along with the introduction of intensive crossbreeding programme. Among the major causes of reproductive failure in cows in Bangladesh, endometritis is a major concern (Shamsuddin *et al.*, 1988). It is associated with postpartum negative energy balance. Affected cows have reduced fertility and increased embryonic loss (Robert and Gilbert, 2016). In recent years, the dairy industry agenda in many countries has been dominated by health-related problems (Vacek *et al.*, 2007).

Reproductive inefficiency is the major problems but limited work done to address these problems in cows particularly in Rajshahi area. Investigation of reproductive abnormalities of cows based on slaughter house survey provides information on the prevalence of reproductive disorders and their occurrence (AL-Dahash and David, 1977). In Bangladesh, many female cattle are slaughtered year-round. Under the circumstances, the female reproductive organs were collected from the slaughter house animals at Rajshahi area with identify the prevalence of diseases, gross examination and evaluate the histopathological changes of the important pathological disorders.

## **MATERIALS AND METHODS**

### **Sample size and study area selection**

The proposed research work was carried out in the Department of Veterinary and Animal Sciences, University of Rajshahi, Rajshahi after collection of 115 samples from the selected eight (08) slaughter houses namely Shaheb Bazar, Katakali, Binudpur, NewMarket, Laximpur, Naodapara, Shalbagan and Horogram bazar under the Rajshahi City Corporation (RCC), which are located at the north side and 261 kms away from Dhaka city.

### **Sampling workflow**

Grossly identifiable lesions such as congested, hemorrhagic and elevated vagina, swollen and edematous cervix, cystic and mucus filled uteri, pus filled horn of uterus, multi-cystic ovary and meso-ovarian cyst in ovary from slaughtered cows of different ages from selected slaughter houses of Rajshahi district at regular intervals used for this investigation.

## Collection and transportation of samples

One hundred fifteen (115) samples were collected randomly from slaughter houses and the samples of different parts of the reproductive system containing gross lesions (vagina, cervix, uterus, fallopian tube and ovary) were collected for histopathological examination in plastic jar containing 10% neutral buffered formalin. These samples were carried to the Laboratory of the Department of Veterinary and Animal and Sciences, University of Rajshahi, Rajshahi.

## Examination of female reproductive organs

### *Gross pathological examination of affected organs*

The observations of various parts of the reproductive organs were done under broad day light. Grossly the entire reproductive system from vulva to ovary was examined for the presence of any detectable abnormalities as previous described (Assey *et al.*, 1998). In order to diagnose different pathological disorders a total of 115 female genitalia were collected from slaughterhouses. That time gross tissue changes were carefully observed and recorded. The following parameters were observed:

- a) In vagina, color of the vaginal mucosa, presence of granulomas, pus, cyst and any inflammatory lesion in the vagina.
- b) In cervix, prolapsed of the cervical ring, pus, exudates and inflammatory changes.
- c) In uterus and fallopian tube, color of mucosa, content such as water, mucus, pus etc., adhesion, cyst, obstruction and both the horns were examined for inflammatory changes, and other pathological abnormalities.
- d) The ovaries that did not show any developmental medium or large sized follicle and did not exhibit the presence of corpus luteum were diagnosed as true anoestrus. The ovaries which exhibited developmental Graafian follicle of medium size were considered as sub-active. Both the ovaries were also examined externally and internally for presence of different kinds of cysts and other pathologic conditions including ovario-bursal adhesions, meso-ovarian cyst and persistent corpus luteum.

## Processing of reproductive organs for histological procedure

After gross examination, representative tissue samples containing lesions were preserved in 10% neutral buffered formalin and transported to the laboratory within 1 hr after collection. Prevalence rate was recorded on the basis of histopathological examination. Adipose tissues surrounding the reproductive organs were removed by careful dissection to clear the organs for a better examination. The formalin-fixed tissues were trimmed, processed, sectioned and stained by Routine staining (H & E) technique following standard histological techniques. Specific lesions containing samples from each group were used in histopathological study. The stained sections of reproductive organs were studied thoroughly under compound microscope using 4X, 10X, and 20X objectives.

## Examination under a microscope

The lesions in the tissues were examined under a low power (4X, 10X) and high-power objectives. The representative lesions were observed for photomicrography.

## Photomicrography

Photomicrography was taken at the Department of Genetic Engineering and Biotechnology Laboratory using microscopy digital USB camera (OPTICA Microscopes, Italy).

## Data interpretation

The percentage of the occurrence of various lesions was termed as the prevalence of the reproductive diseases. At the end of the study period all findings were compiled, scrutinized and analyzed for comprehensive interpretation. The result was presented as percentage.

# RESULTS

## Results of gross pathological examination

Gross study was performed during collection of samples from slaughter houses primarily and then during trimming of the samples for histopathology. The occurrence of the various disorders of the female reproductive system was shown in [Table 1](#). One hundred and fifteen reproductive tract of cows were examined in eight abattoirs under Rajshahi district of which most of

the reproductive tract were infected with one or more lesion(s) and which led the diagnosis of granular vulvo-vaginitis, enlarged, hemorrhage and swollen cervix i.e. cervicitis, aplasia of cervical ring, hemorrhage in uterus i.e. hemorrhagic endometritis, hemorrhage in the horn of the uterus i.e. chronic endometritis, pyometra, mucometra, parasitic cyst within the uterus, follicular cyst, luteal cyst, multi-cystic ovary and meso-ovarian cyst etc.

### Granular vulvo-vaginitis

The vaginas were swollen and reddish in color. Out of 115 cows, 11 (9.57%) were identified with granular vulvo-vaginitis. It was confirmed by observing numerous nodular lesions (0.5 to 1.50 mm in diameter) with congestion and mild catarrhal exudates on the mucosal surface of vagina and vulva (Figure 1C) and 9 (7.82%) were identified with vaginitis showing diffuse congestion and mucus exudates on the mucosal surface of vagina (Figure 1D).

### Enlarged, hemorrhagic and swollen cervix

The affected cervix appeared edematous swelling and highly congestion as seen is cervicitis (C) (Figure 2). The number of animals suffering from cervicitis was found to be 12 (10.43%). Dilatation and congestion of the cervix with yellowish mucus exudates on the mucosal surface as seen is chronic cervicitis (D) (Figure 2).

### Aplasia of cervical ring

Only the first ring of the cervix was present.

### Endometritis

Endometritis was diagnosed in 22 (19.14%) cases. Hemorrhagic endometritis of the uterus characterized by petechial and ecchymotic haemorrhages in the endometrium (C) (Figure 3) and chronic endometritis characterized by edematous swelling, hemorrhages and highly congestion in the endometrium (D) (Figure 3).

### Mucometra

03 (2.61%) case of mucometra was diagnosed out of 115 genitalia. The uterus appeared to be larger, contain a large amount of yellow reddish color slimy mucus. Reddish colored and purulent mucus were present after opening the uterus or horn of uterus.

### Pyometra

During post-mortem examination, 6 (5.21%) case was recorded as pyometra. The uterus was enlarged in size, highly congested caruncles with horn and contained cream color pus with foul odor (Figure 4).

### Parasitic cyst within the uterus

Parasitic cyst was detected in 01 (0.87%) case. The cyst was present in the entire uterus (Figure 5).

### Meso-ovarian cyst

Only one (0.87%) case of meso-ovarian cyst was detected. The cyst was found to be attached to the meso-ovarium/ mesosalpinx measured 17 mm in diameter as a clear spherical cyst (Figure 6).

Table 1: Percentage of pathological disorders of reproductive system of cows observed during post-mortem examination in the abattoirs.

Pathological disorder of the reproductive organs	No. of affected animals	Percent of disorder (%)	Total no. of genitalia examined
Granular vulvo-vaginitis	11	9.57	115
Vaginitis	9	7.82	
Aplasia of cervical ring	3	2.61	
Cervicitis	12	10.43	
Endometritis	22	19.14	
Pyometra	6	5.21	
Mucometra	3	2.61	
Parasitic cyst within the uterus	1	0.87	
Follicular cyst	11	9.57	
Luteal cyst	3	2.61	
Multicystic ovary	2	1.73	
Meso-ovarian cyst	1	0.87	
Total	84	73.04	



Table 2: Histopathological findings of different organs of the reproductive system of cows.

Histopathological disorders	No. of affected animals	% Of cases on the basis of disorder	Total no. of genitalia examined	Overall prevalence among examined cases (%)
Endometritis	17	30.36	115	48.7%
Cervicitis	12	21.42		
Vaginitis	13	23.21		
Follicular cyst	10	17.87		
Multicystic ovary	4	7.14		
Total	56	100		

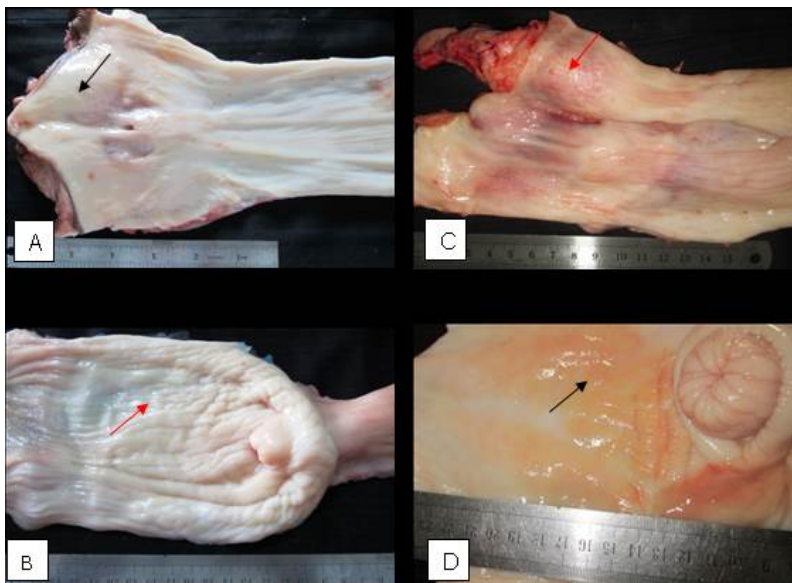


Figure 1: The longitudinal section of healthy vagina showing shiny, smooth and light cream in colour (arrow) on the mucosal surface (A, B) compare to the longitudinal section of vagina of a 7-year-old cow showing numerous nodular lesions (arrow) (0.5 to 1.50 mm in diameter) with congestion and mild catarrhal exudates (C) as seen is granulovulvo-vaginitis and of a 6-year-old cow showing diffuse congestion (arrow) and mucus exudates on the mucosal surface (D) as seen is vaginitis.

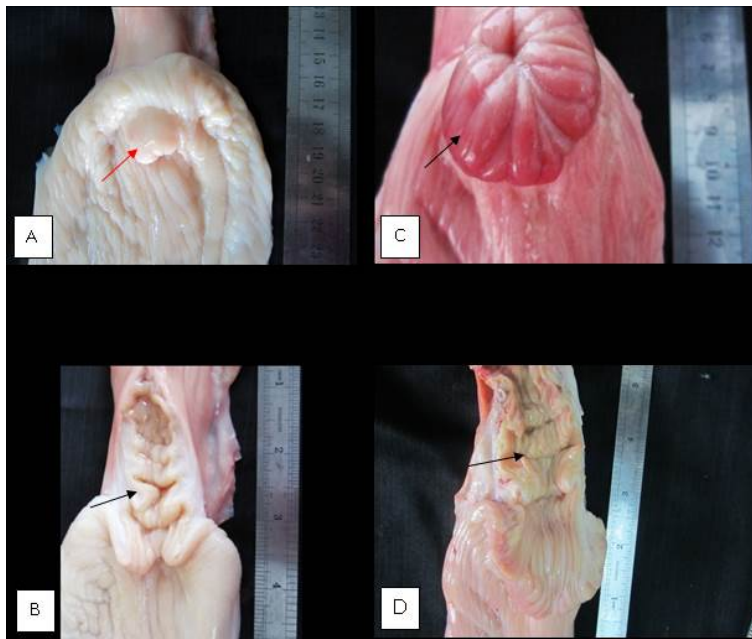


Figure 2: The longitudinal section of healthy cervix showing shiny, smooth and light cream in colour (arrow) on the mucosal surface (A, B) compare to the cervix of an 8-year-old cow showing (arrow) edematous swelling and highly congestion (C) as seen is cervicitis and of an 8-year-old cow showing (arrow) congestion, edematous and yellowish mucus exudates on the mucosal surface (D) as seen is chronic cervicitis.

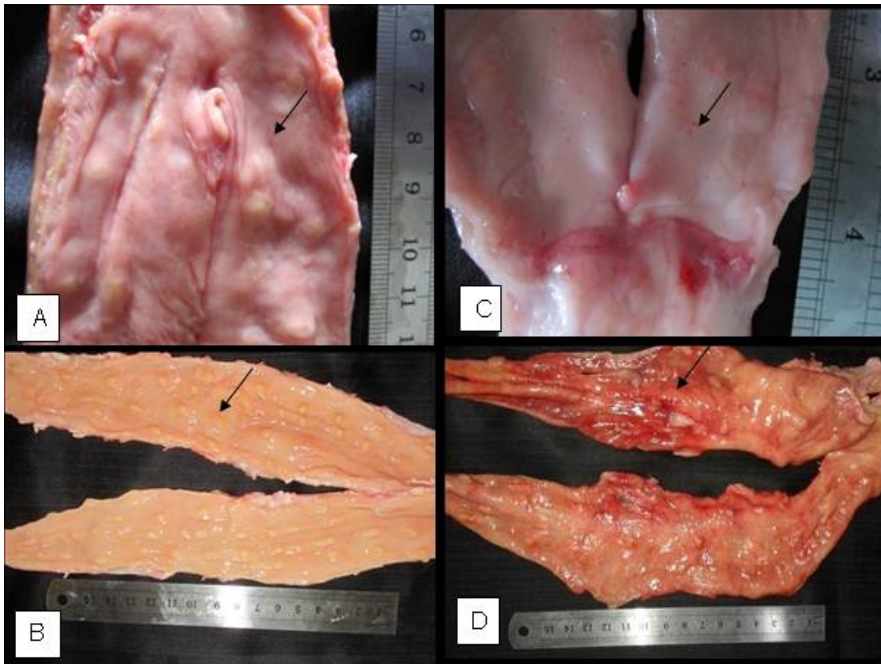


Figure 3: The longitudinal section of healthy uterus and horn showing shiny, smooth and light cream in colour (arrow) in the endometrium (A, B) compare to the longitudinal section of uterus of an 8-year-old cow showing petechial and ecchymotic haemorrhages (arrow) in the endometrium (C) as seen is haemorrhagic endometritis and of a 5-year-old cow showing edematous swelling, haemorrhages and highly congestion (arrow) in the endometrium (D) as seen is chronic endometritis.

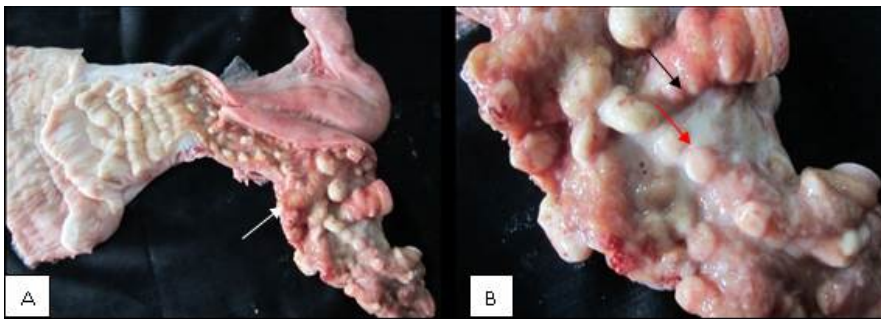


Figure 4: The longitudinal section of uterus and horn of uterus of a 9-year-old cow showing highly congested caruncles with horn (black and white arrow) and contained cream color pus with foul odor (red arrow) both A & B as seen is pyometra.

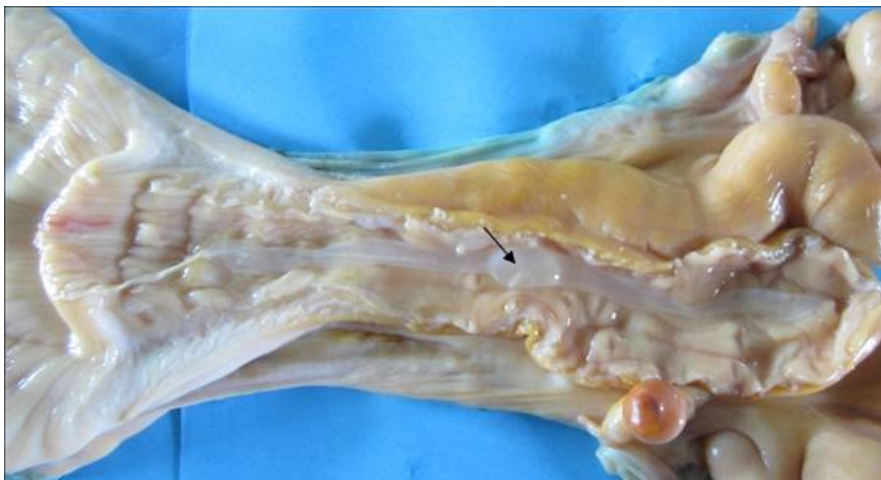


Figure 5: The longitudinal section of uterus and horn of uterus of an 8-year-old cow showing parasitic cyst (arrow) in the entire uterus.

### Follicular cyst

Out of 115 genitalia, the follicular cysts were diagnosed in 11 (9.57%) cases. The cyst was 20 mm in diameter, thin walled and soft on palpation. There were cystic structures filled with clear fluid and protruding to the surface of the ovary (Figure 7).

### Luteal cyst

Three (2.61%) cases were recorded as luteal cyst. The formalin fixed ovary (cystic ovary) showing (6.10 mm in diameter) containing large corpus luteum (CL) that occupying almost entire areas of the ovarian parenchyma (Figure 8).



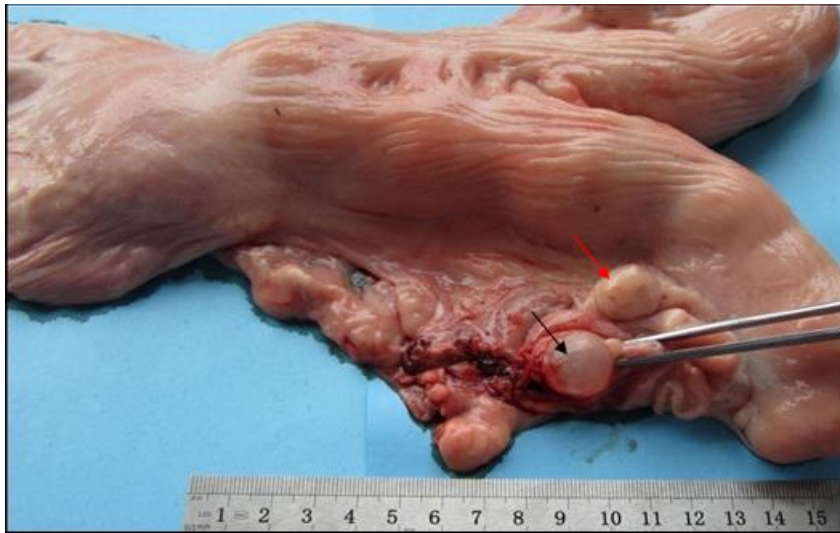


Figure 6: The reproductive tract of an 8-year-old cow showing ovary (red arrow) and mesovarian cyst (black arrow) measured 17 mm in diameter.

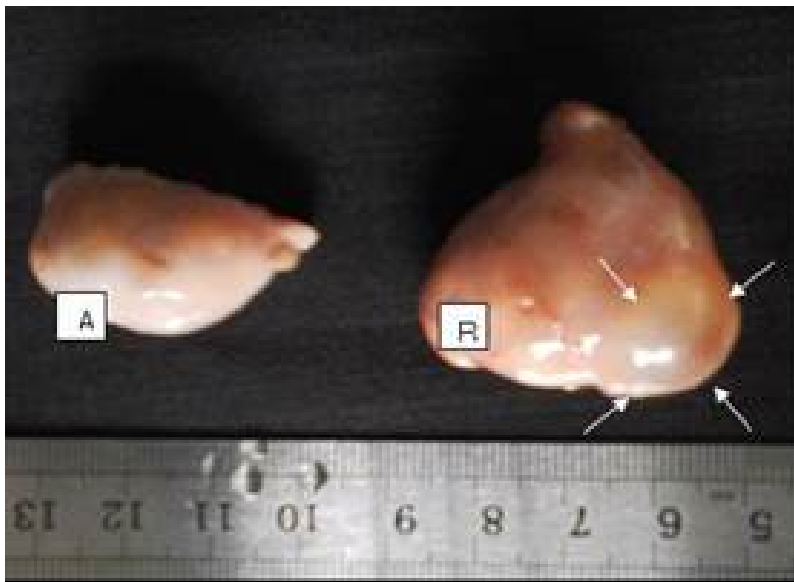


Figure 7: The ovary of a 6-year-old cow containing large follicular cyst (B) was (21 mm in diameter), thin walled, soft on palpation and contain clear fluid (arrow) compare to the left (A) as seen is normal.

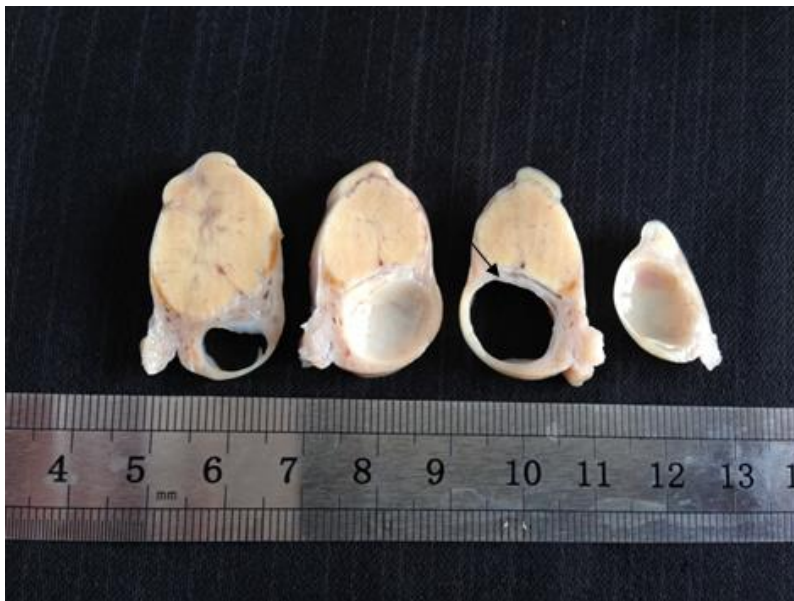


Figure 8: The longitudinal section of luteal cyst of a 7-year-old cow of formalin fixed ovary (cystic ovary) showing (6.10 mm in diameter) containing (arrow) large corpus luteum (CL) that occupying almost entire areas of the ovarian parenchyma

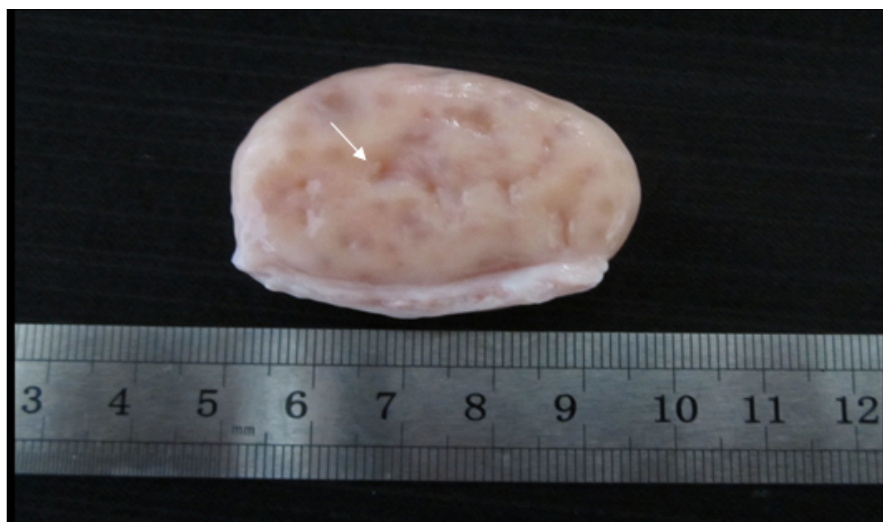


Figure 9: The ovary of an 8-year-old cow showing (arrow) multiple cysts ranging from 2.25 4.00 mm (average 2.425 mm) in diameter.

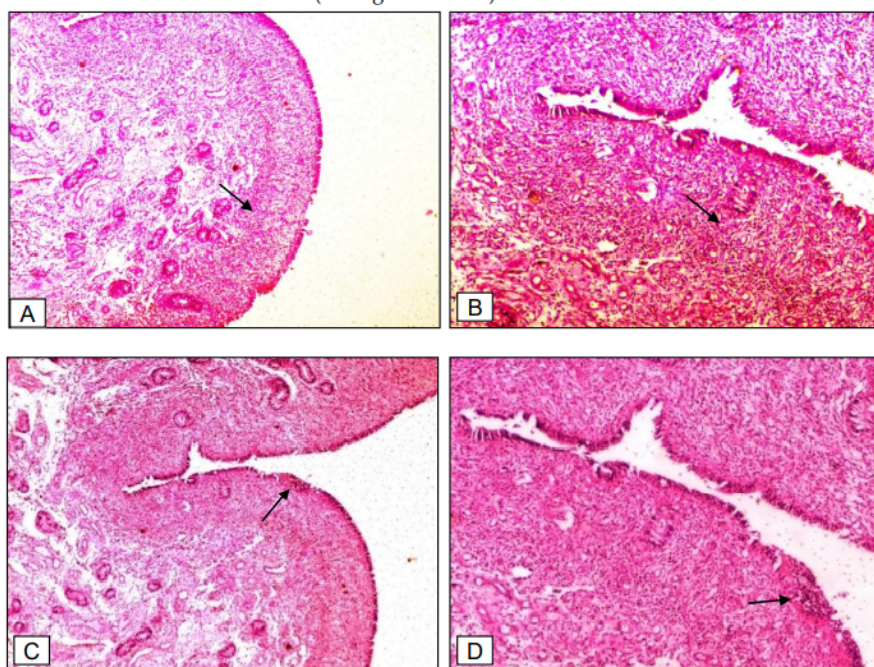


Figure 10: The section of uterus showing proliferation of fibrous connective tissue and infiltration of lymphocytes, macrophages (arrow) in the endometrium indicating a state of endometritis (C, D) and normal (A, B) in (H & E, 4X and 10X).

### Multicystic ovary

During post-mortem examination, 02 (1.73%) cases were recorded as multicystic ovary. The cyst showing multiple cysts ranging from 2.25 ~ 4.00 mm (average 2.425 mm) in diameter on the surface of ovary (Figure 9).

### Histopathological examination

The relative incidence of various histopathological disorders observed under microscope was shown in Table 2. The prevalence of abnormalities of genital system of dairy cows at slaughter house was 48.7%. The incidence of endometritis was found to be high-

est (30.36%) followed by vaginitis (23.21%), cervicitis (21.42%), follicular cyst (17.86%) and multicystic ovary (7.14%) which was reconfirmed by histopathological studies.

Endometritis which was the most common pathological disorders encountered during examination characterized by proliferation of fibrous connective tissue and infiltration of lymphocytes, macrophages (arrow) in the endometrium indicating a state of endometritis (C, D) and normal (A, B) (Figure 10) and showing infiltration of lymphocytes and macrophages within the lumen of the endometrial gland (D, E) (arrow) and thickening of the endometrial wall (arrow) showing proliferation of connective tissue associated with infiltration of lym-



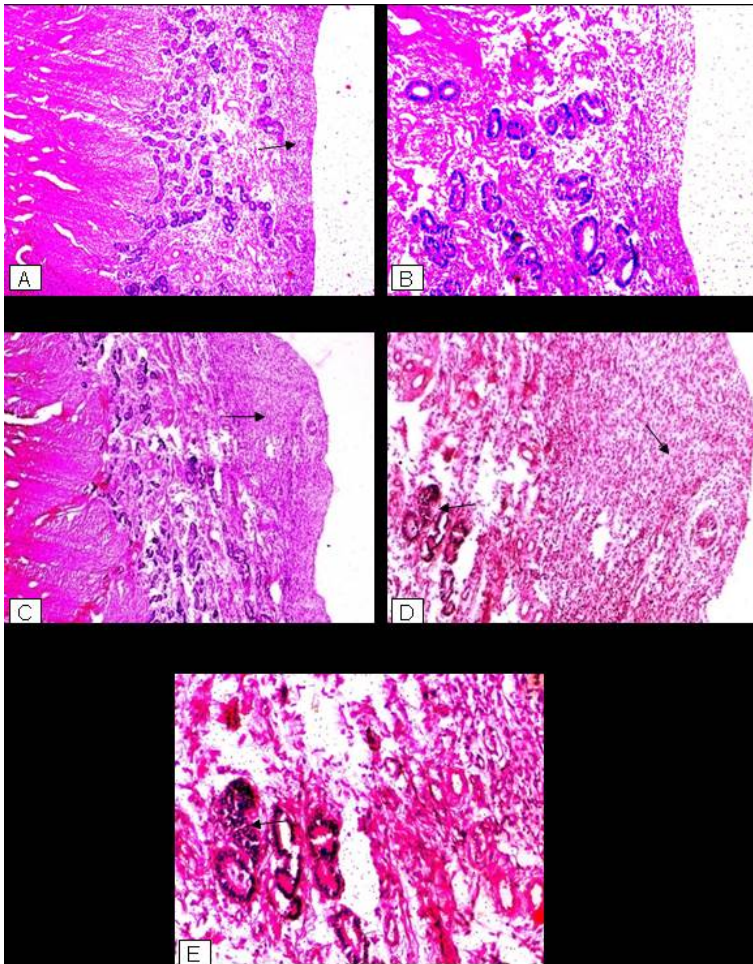


Figure 11: The section of horn of uterus showing infiltration of lymphocytes and macrophages within the lumen of the endometrial gland (arrow) and thickening of the endometrial wall (arrow) showing proliferation of connective tissue associated with infiltration of lymphocytes and macrophages indicating a state of chronic endometritis (C, D), higher magnification of the above slide (E) and normal (A, B) in (H & E, 4X and 10X).

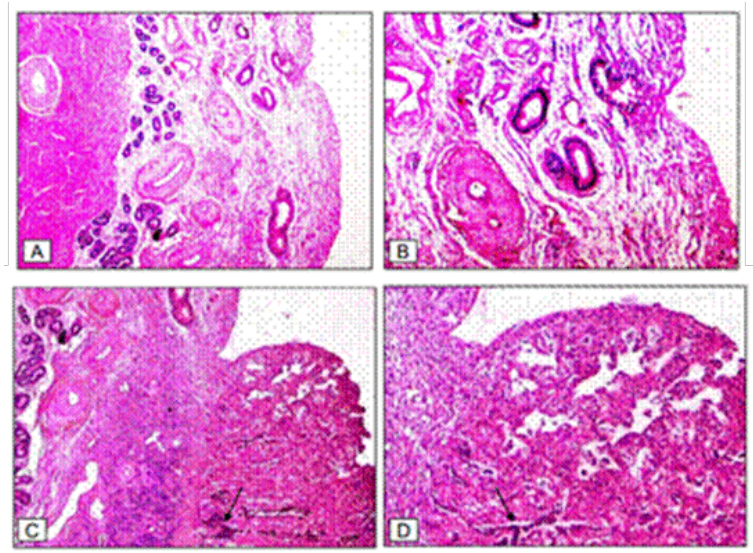


Figure 12: The section of vagina showing leukocytic infiltration in the lamina propria which consists of macrophages, neutrophils and lymphocytes (arrow) (C, D) and normal (A, B) in (H & E, 4X and 10X).

phocytes and macrophages indicating a state of chronic endometritis (C, D), higher magnification of the above slide (E) and normal (A, B) (Figure 11).

The second most common pathological condition observed under microscope was vaginitis characterized by hyperemia and leukocytic infiltration in the lamina

propiawhich is consists of lymphocytes, macrophages and neutrophils (C, D) and normal vagina (A, B) (Figure 12) and showing leukocytic infiltration mainly lymphocytes, neutrophils (arrow) below the epithelial layer of mucosa and in the peri-glandular area (arrow) of lamina propria of vagina (C, D) and inflammatory cells



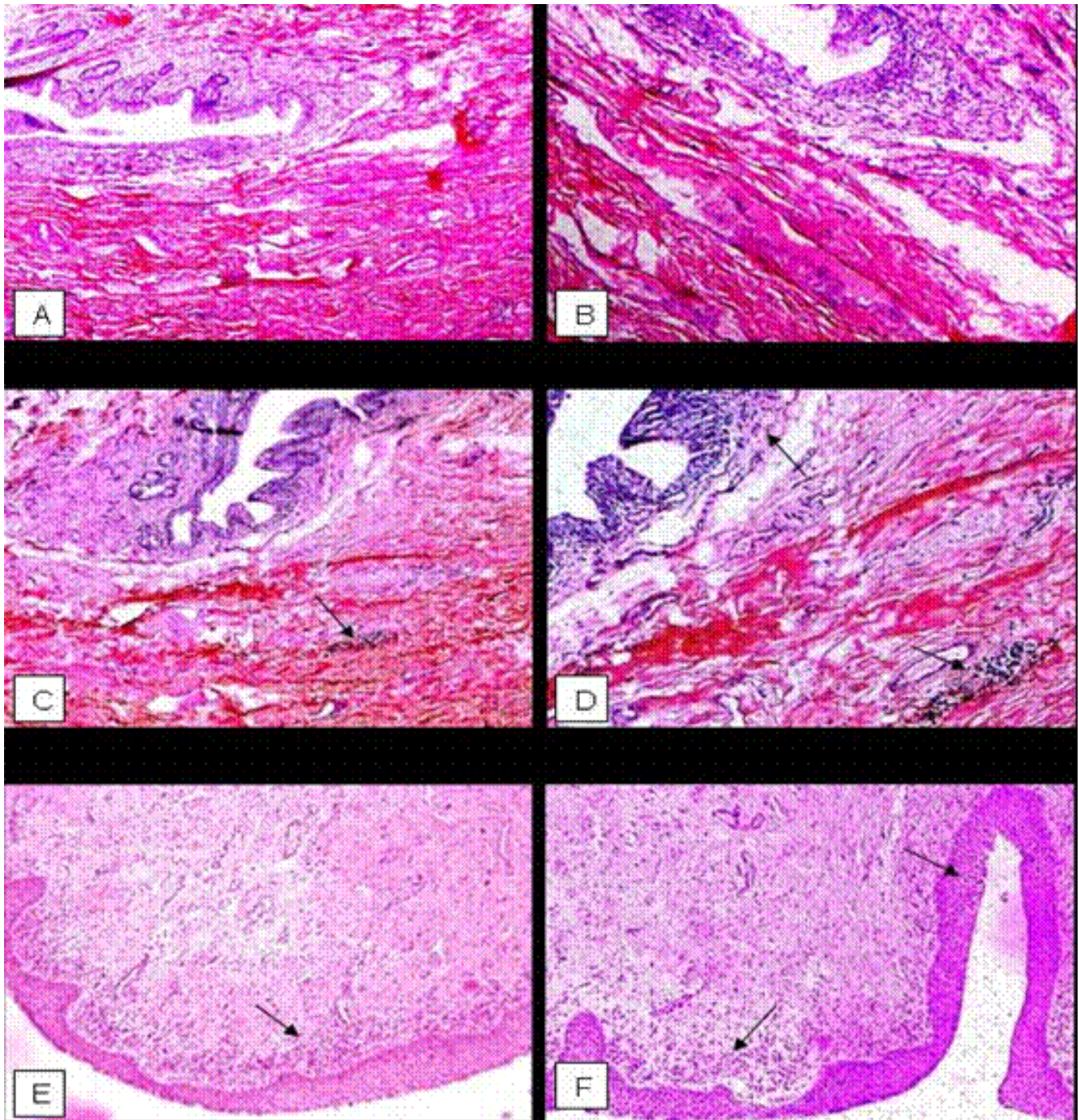


Figure 13: The section of vagina showing leukocytic infiltration mainly lymphocytes, neutrophils (arrow) below the epithelial layer of mucosa and in the peri-glandular area (arrow) of lamina propria of vagina (C, D) and inflammatory cells mainly neutrophils and lymphocytes below the stratified squamous epithelia of mucosal layer (arrow) (E) and intraepithelial leukocytic infiltration in the stratified squamous epithelial layer (arrow) (F) of vagina and normal (A, B) in (H & E, 4X and 10X).



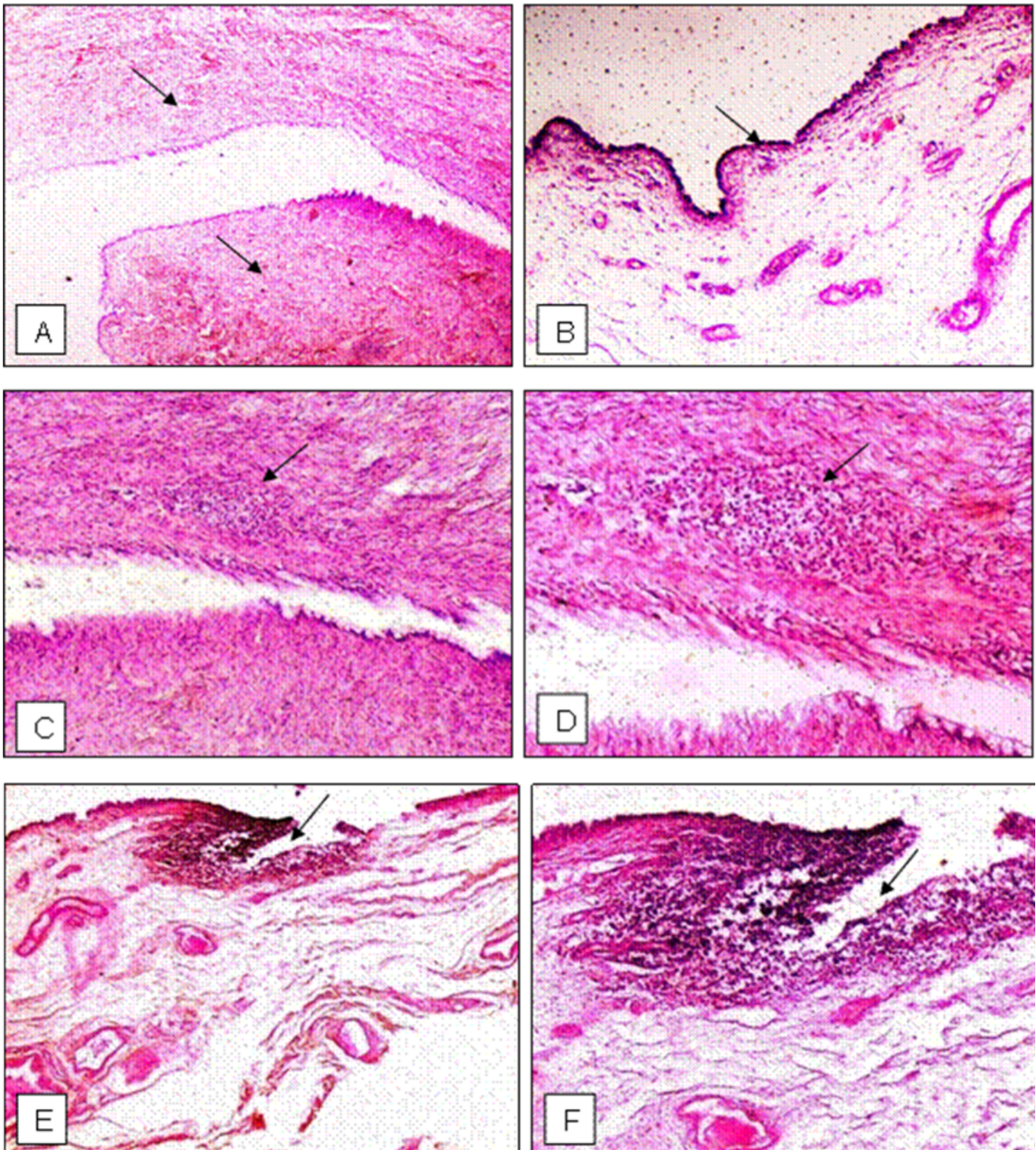


Figure 14: External surface of the cervix showing leukocytic infiltration mainly lymphocytes associated with connective tissue proliferation indicating a state of chronic cervicitis (C, D) and leukocytic infiltration mainly lymphocytes with erosion of the epithelial layer (arrow) indicating a state of cervicitis (E, F) and normal (A, B) in (H & E, 4X and 10X).



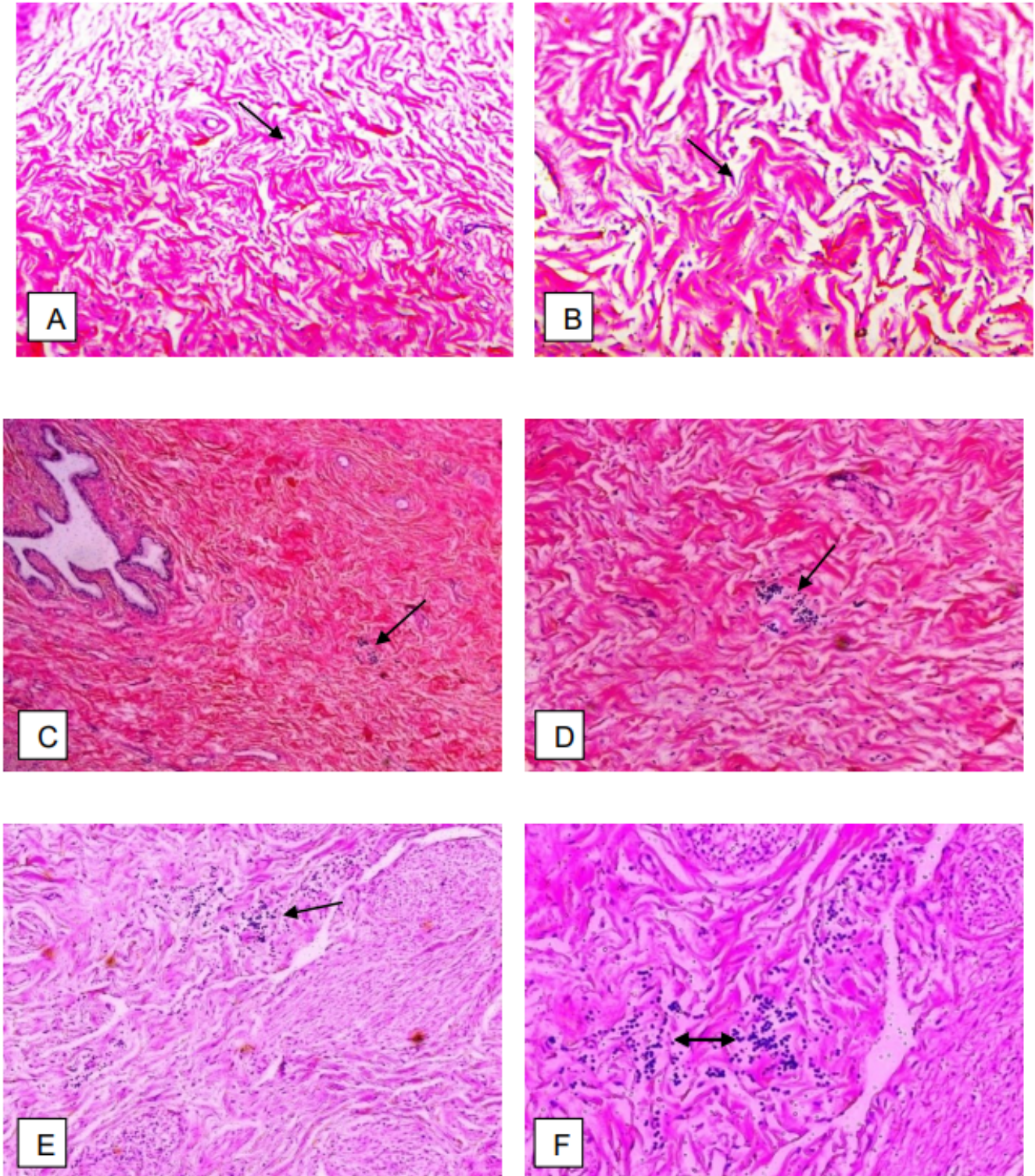


Figure 15: The section of cervix showing lymphocytic infiltration in muscularis layer (arrow) (C), epithelium of the endocervix showing lymphocytic infiltration (arrow) (D), leukocytic infiltration (arrow) mainly lymphocytes and neutrophils in the muscularis layer indicating a state of cervicitis (E, F) and normal (A, B) in (H & E, 4X, 10X and 20X.



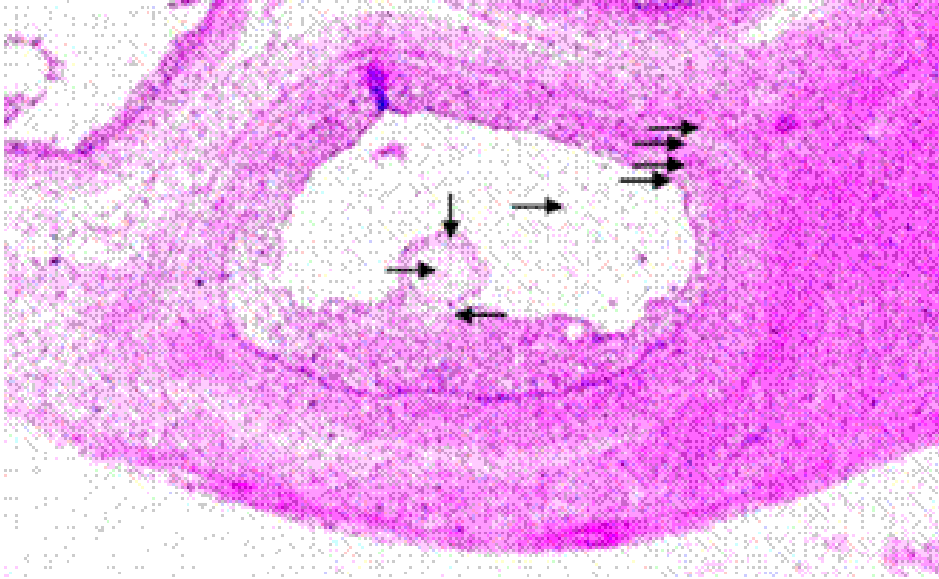


Figure 16: Presence of normal structures of mature Graafian follicle which is characterized by presence of potential ovum, corona radiate, cumulus ophorus, antrum (contain liquor follicle), basement membrane, granulose cells, theca intema and theca externa (H & E, 4X).

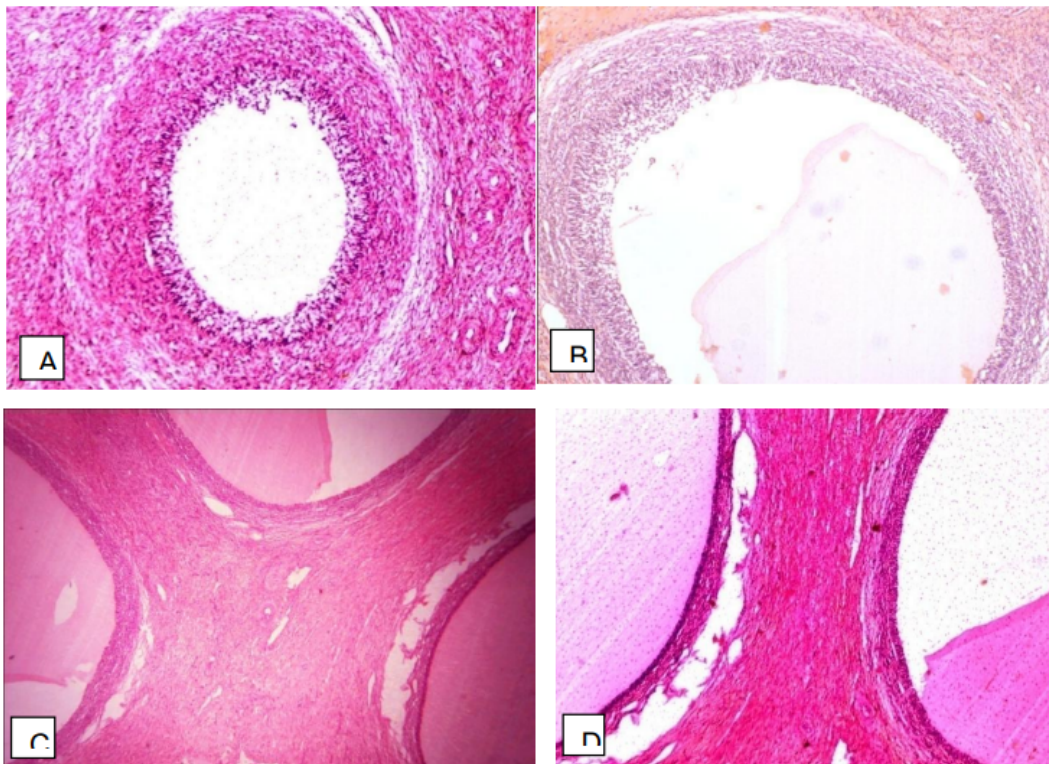


Figure 17: Microscopic figure of follicular cyst in ovary showing dilatation of the secondary follicles, which is characterized by presence of pink color proteineicious liquor folliculi, thinness of granulose cells and absolutely absence of ovum (A, B) and multicystic ovary (C, D) in (H & E, 4X and 10X).

mainly neutrophils and lymphocytes below the stratified squamous epithelia of mucosal layer (arrow) (E) and intraepithelial leukocytic infiltration in the stratified squamous epithelial layer (arrow) (F) of vagina and normal (A, B) (Figure 13). Cervicitis was characterized by infiltration of lymphocytes associated with connective tissue proliferation indicating a state of chronic cervicitis (C, D) and leukocytic infiltration mainly lymphocytes with erosion of the epithelial layer (arrow) indicating a state of cervicitis (E, F) and normal (A, B) (Figure 14) and intense infiltration of lymphocytes in the muscularis layer indicating a state of cervicitis (C, D, E, F) and normal (A, B) (Figure 15). Normal structures of mature Graafian follicle which is characterized by presence of potential ovum, corona radiata, cumulus oophorus, antrum, granulosa cells and basement membrane (Figure 16). Follicular cyst, which was common pathological disorders encountered during examination showing by dilatation of the secondary follicles, which is characterized by presence of pink color proteinaceous liquor folliculi, thinness of granulosa cells and absolute absence of ovum (A, B) (Figure 17). Multicystic ovary showing dilatation of the secondary follicles, which is characterized by presence of pink color proteinaceous liquor folliculi, thinness of granulosa cells and absolute absence of ovum (C, D) (Figure 17).

## DISCUSSION

In Bangladesh cattle is an economically important animal. But this animal is often found to suffer from different reproductive disorders (Rahman *et al.*, 1993). Various pathological disorders in reproductive system resulted serious economic loss and reduce production efficiency in cows all over the world. The condition is much worse in our country. The incidence of various reproductive pathologies has increased menacingly in this country probably due to introduction of intensive cross breeding programme through artificial insemination. Improvement of animal production largely depends on proper reproductive efficacy. It is worth to note that for the improvement of reproductive performance availability of base line data on the existing reproductive statuses is an important criterion to formulate a development plan. The present work was therefore undertaken to investigate into the disorders of female reproductive system in cows.

## Gross examination

A total of 115 female genitalia were examined grossly and the findings were hemorrhage in uterus and horn of the uterus i.e., endometritis, enlarged, hemorrhage and swollen cervix i.e., cervicitis, granular vulvovaginitis followed by follicular cyst, vaginitis, pyometra, luteal cyst, mucometra, aplasia of cervical ring, multicystic ovary, parasitic cyst within the uterus and meso-ovarian cyst. Although very few reports are available on such disorders in cows of Bangladesh and the result of gross study are more or less same with the reports of (Shahabuddin, 1996). Based on gross pathological examination, it can be suggested that endometritis, cervicitis and granular vulvovaginitis were most common affections in the reproductive system followed by follicular cyst, vaginitis, pyometra, luteal cyst, mucometra, aplasia of cervical ring, multicystic ovary, parasitic cyst within the uterus and meso-ovarian cyst.

The occurrence of endometritis was frequently observed. On gross examination of freshly collected genitalia showed 19.14% endometritis. Endometritis, acute or chronic type, is the most common pathological disorders in the female reproductive system of cattle. Sham-suddin *et al.* (1988) recorded 10.38% metritis and Borsberry and Dobson (1989) recorded 14.80% endometritis and they concluded that endometritis is the principal cause of breeding failure in Bangladesh. It is a worldwide problem of dairy cows. Markusfeld (1984) reported a high incidence of endometritis in Israeli cows.

Alam (2010) examined 42 genitalia and 16.7% endometritis was diagnosed. The present findings were lower than that of others (Shahabuddin, 1996; Kunbhar *et al.*, 2003; Hasan *et al.*, 2015) which were 32.58%, 38.5% and 31.29%, respectively. Ali *et al.* (2006) collected 110 reproductive tracts of cows from Faisalabad abattoir and recorded 9.09% metritis. LeBlanc (2012) reviews recent data and concepts on the development of inflammation in the reproductive tract of dairy cows during the first 2 months after calving. The incidence of metritis is 10-20%, with 5-15% of cows having purulent vaginal discharge (PVD), 15-40% having cervicitis approximately 1 month after calving, and 10-30% having cytological endometritis between 1 and 2 months after calving. The author found that endometritis, cervicitis and PVD are distinct conditions, each of which is associated with significantly increased time to pregnancy. The present findings of the incidence of endometritis are in full agreement with reports of other workers (Garoussi *et al.*, 2010; Ahmed, 2011; Sayyari *et al.*, 2012). About 27.4% and 27.8% endometritis were



recorded by [Shamsuddin et al. \(1988\)](#) and [Akhter et al. \(2013\)](#) respectively. In this study, the findings are higher than that of others ([Kubar and Jalakas, 2002](#); [Abalti et al., 2006](#); [Patel et al., 2007](#); [Gebrekidan et al., 2009](#); [Mekibib et al., 2013](#); [Kilinc and Oruc, 2014](#)). [Hatipoglu et al. \(2002\)](#) recorded 1.26% endometritis which was very low. [Narasimha Rao \(1982\)](#) reported that about 13.97% cows suffered from endometritis among the principal causes of reproductive failure in cows of this country. These variations in results due to breed, health condition, failure of early detection of diseases or managemental problems.

The second higher incidence of gross disorder was cervicitis (10.43%). [Roberts \(1971\)](#) stated that prolapse of the external transverse cervical rings or cervical ectropion was a possible factor causing cervicitis in older cows. The results of our study showed similarities with the results obtained by [Ahmed \(2011\)](#), [Soonwuk et al \(1996\)](#), [Anita et al. \(2013\)](#), which were 11.1%, 10% and 11.53%, respectively. 11.9% cervicitis was recorded by [Alam \(2010\)](#). Studies of [Narasimha Rao \(1982\)](#) recorded 5.52% cases of cervicitis. [Kunbhar et al. \(2003\)](#) examined 100 genitalia and 27.7% cervicitis was recorded. About 3.74%, 6.36% and 3.26% cervicitis were recorded by [Shahabuddin \(1996\)](#); [Ali et al. \(2006\)](#); [Garoussi et al. \(2010\)](#). A state of 9.57% granular vulvovaginitis and 7.82% vaginitis recorded in this study. [Jones et al. \(1997\)](#) observed grossly a case of granular vulvovaginitis, eruptions appeared as both pale and pink elevated papules, a few millimeters in diameter, usually covered by a catarrhal exudate that exuded from the vulva and microscopically, each papule consisted of a hyperplastic lymphoid follicle that often is congested or contains areas of hemorrhage. These lesions are almost similar with the present study. The present study is compatible to the findings obtained in the study conducted by [Kunbhar et al. \(2003\)](#) and [Alam \(2010\)](#), which are 10.89% and 9.5%, respectively and 7.5% vaginitis by [Ahmed \(2011\)](#). In a study, 2.4% granulovulvovaginitis and 0.2% vaginitis recorded ([Nair and Raja, 1975](#)). Whereas, 5.76%, granular vulvovaginitis reported by [Anita et al. \(2013\)](#). About 2.04%, 1.35% and 4.34% vaginitis were recorded by [Rahman et al. \(1993\)](#); [Hatipoglu et al. \(2002\)](#); [Garoussi et al. \(2010\)](#), respectively. The variation might be due to breed, age, hygienic condition or managemental problems.

Other gross abnormalities in the present study, 9.57% follicular cyst, 2.61% luteal cyst, 1.73% multicystic ovary, 0.87% mesovarian cyst, 5.21% pyometra, 2.61% mucometra were recorded. Studies of [Ahmed \(2011\)](#) recorded 7.5% follicular cyst, 2.5% luteal cyst,

5% pyometra and 2.5% mucometra. About 7.1% follicular cyst, 2.4% pyometra and 2.4% mucometra were recorded by ([Alam, 2010](#)). About 3.5% and 5.61% cystic ovaries were recorded by some studies ([Abalti et al., 2006](#); [Shahabuddin, 1996](#)). In some studies, 13.0%, 1.88% and 4.35% follicular cyst observed by [Kubar and Jalakas \(2002\)](#); [Hatipoglu et al. \(2002\)](#); [Mekibib et al. \(2013\)](#), 0.36% mucometra by [Hatipoglu et al. \(2002\)](#), 0.5% and 0.8% pyometra reported by [Sayyari et al. \(2012\)](#) and [Patel et al. \(2007\)](#). About 1.4% luteal cyst were recorded by ([Kubar and Jalakas, 2002](#)). In another study, ([Kubar and Jalakas, 2002](#)) examined 39 cows where 1 (2.6%) mucometra were recorded. The author also stated that most ovarian cysts were follicular cysts and only one third of the animals also (33.3%) luteal cysts. In the present report there is also an exceptional finding within uterus i.e., parasitic cyst in the entire uterus. The percentage of the finding is negligible but it focuses the importance of uterine findings. On the other hand, [Kunbhar et al. \(2003\)](#) examined 100 genitalia of Thari cows and found that the most affected part of the tract was (70.8%) uterus followed by (64.6%) cervix, (60.0%) oviduct, (49.2%) ovaries and (38.5%) vagina. He recorded 10.8% follicular cyst, 7.7% luteal cyst, 43% pyometra, 12.3% hydrometra and mucometra and 6.2% cysts on uterine wall. [Kang et al. \(1994\)](#) examined 60 cattle and recorded 11.7% follicular cyst and 11.7% luteal cyst. In a study, [Akhter et al. \(2013\)](#) diagnosed of different pathological conditions of 54 sub-fertile cow's genital tract and the problems were diagnosed as 11.1% pyometra, 3.7% mucometra, 9.2% follicular cyst and 1.9% luteal cyst. In a study, 2.72%, 5.5%, 3.3%, 8.13%, 8.37% ovarian cysts and 6.36%, 1.87%, 4.84% pyometra were recorded by [Ali et al. \(2006\)](#); [Gebrekidan et al. \(2009\)](#); [Simenew et al. \(2011\)](#); [Mohammad \(2013\)](#); [Hasan et al. \(2015\)](#), respectively. [Kilinc and Oruc \(2014\)](#) examined 224 cows and lesions were recorded follicular cyst 3.57%, luteinized cyst 0.89%, mucometra 1.34% and pyometra 0.89%. Besides the other gross pathological disorders recorded in the study were more or less similar with those of [Alam \(2010\)](#) and [Ahmed \(2011\)](#). The variation might be due to breed, age, lack of proper education or hygienic management of the postpartum cows and limited veterinary services have aggravated the situation.

### Histopathological examination

Among the histopathological disorders prevalence of endometritis was highest and the percentage was (30.36%) followed by vaginitis, which was the second

highest (23.21%). Tafti and Darahshiri (2000) examined 39% endometritis by microscopic examination. In a study of Alam (2010), the rate of 21.4% endometritis, 17.9% cervicitis, 14.3% vaginitis, 10.7% follicular cyst and 3.6% luteinoma in ovary were recorded. 27 (18%) endometritis was recorded by Talib and Faraidoon (2014). Chronic endometritis was the most common microscopic lesion in cows with (34.61%) or without (17.94%) recorded reproductive disease observed by Garoussi *et al.* (2010). Nahar (2010) examined 20 uteri histopathologically and recorded (33.33%) acute endometritis and (26.66%) chronic endometritis. In a study of Ahmed (2011) 15% endometritis, 12.5% cervicitis, 10% vaginitis and 7.5% follicular cyst were recorded. 27.39% endometritis were recorded by Shamsuddin *et al.* (1988). The occurrence of endometritis was higher than these values obtained by Abalti *et al.* (2006) and LeBlanc (2008) which were 3.9% and 15-20%, respectively. This variation may be due to number of samples examined, selection of samples and site examined. The histopathological study of endometritis corresponded with the findings of Gustafsson *et al.* (2004). The relative incidence of other histopathological disorders observed under microscope were vaginitis (23.21%), cervicitis (21.42%), follicular cyst (17.87%) and multicystic ovary (7.14%).

Most researcher agreed that occurrence of different pathological disorders in the reproductive system are more frequent in high milk producing cows (44%) than the medium milk producing (32%) counterparts (Nakao *et al.*, 1992). A number of factors influence the intensity and prevalence of reproductive disorders including the species and pathogenicity of the causative agent, the cellular and immunological defensive mechanisms, hormonal imbalance, and dietary status of the animal concerned and environmental sanitation.

## CONCLUSIONS

The present research work was undertaken to detect pathological disorders of female reproductive system in cows based on gross and histopathological characteristics. The incidence of various reproductive disorders especially cervix and uterine infections in the form of vaginitis, cervicitis, hemorrhage in the uterus and horn of uterus i.e., endometritis and chronic endometritis, pyometra and mucometra has increased alarmingly in this subcontinent with the introduction of cross breeding programme among high yielding varieties of cows. Infection in any segment of female reproductive tract

could impair process of fertility. It may be opined that various pathological disorders in the female reproductive system seriously affect the production potentiality and thereby causing economical losses. These disorders in the female genital organ of cows would enable us to design future research and hygienic care at breeding and parturition should be into consideration and also support to manage the different fertility related problems in cows.

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## CONFLICT OF INTERESTS

None of the authors have any conflict of interest of declare.

## AUTHORS' CONTRIBUTION

MJUS designed and supervised the research work. MMH helped in preparation of histopathological part. RK collected samples and data, conducted the experiments, wrote the initial draft of the manuscript and finally read and approved the manuscript before submission.

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