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Reliability of ultrasonography for diagnosing genital tract abnormalities in buffaloes

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ABSTRACT

The present work was planned to assess the reliability of ultrasonography in diagnosing genital tract abnormalities in non-gravid genitalia (n=505) of buffaloes collected from private abattoirs. Ultrasonography was done using 7.5MHz linear probe after immersing genitalia in a water tub. Thereafter, genitalia were examined visually and were dissected with a scalpel blade to assess any abnormalities in the tubular tract/ovarian stroma. Grossly, abnormalities were observed in 53.70 percent genitalia. Sensitivity, specificity and predictive values of the ultrasonographic diagnosis in comparison to that of macroscopy/dissection concluded that reliability of ultrasonography was above 85 percent in diagnosing various genital tract abnormalities except for cervicitis and pyometra wherein sensitivity was low.

Key words: Ultrasonography, Macroscopy, Genital tract, Abnormalities, Buffalo.

A large number of buffaloes in India fail to conceive due to genital tract abnormalities. For their diagnosis, both per-rectal and ultrasonographic examinations are being utilized. Comparison of rectal palpation, ultrasonography and macroscopy in cattle has found rectal palpation to be less accurate in comparison to ultrasonography for diagnosing genital tract abnormalities (Aslan *et. al.*, 2000). However, in buffaloes, the accuracy of ultrasonography in diagnosing various genital tract abnormalities is not clear. The present study was undertaken to establish the reliability of ultrasonography, by comparing it with gross examination, in determining the occurrence of genital tract abnormalities in buffaloes.

A total 505 non-gravid genitalia of gynaecologically inconspicuous buffaloes were collected from private abattoirs located in Punjab and Uttar Pradesh. Immediately after collection, genitalia were transported in ice to the laboratory and were numbered using plastic tags. Ultrasonographic and macroscopic (gross) examination of the genitalia was completed within eight hours of collection.

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Ultrasonography:

Genital tracts were thoroughly washed and then immersed in a bucket containing fresh water. For diagnosing different genital tract abnormalities, ultrasonographic examination of the genitalia was done with a B-mode ultrasound scanner using 7.5MHz linear array transducer. Each ovary was scanned in several planes by moving the transducer along its surface to identify any abnormal ovarian structures. Thereafter, the transducer was placed over the fallopian tubes, uterine horns, body of uterus and cervix in longitudinal and transverse manner to obtain the longitudinal and cross sectional images of the lumen of these structures.

Macroscopy:

Incidence of ovarian, fallopian tube, uterine and cervical abnormalities was grossly noted. The tubular genitalia were opened to confirm any luminal abnormalities.

Phenolsulphonphthalein (PSP) dye test:

For testing the patency of fallopian tubes, a Foley type embryo flushing catheter was introduced into one horn through the cervix, the cuff was inflated and a small volume of PSP dye was infused into the tip of horn as described by Coulthard (1980). The cuff prevented reflux of dye to the other side. In patent fallopian tubes, the dye passed out of the ovarian bursa via the fallopian tubes whereas in non-patent cases, it failed to come out of the bursa.

Statistical analyses:

Data generated with respect to incidence of genital tract abnormalities was subjected to Z-test (Singh *et. al.*, 1991, Table 1). Sensitivity (a/a+b), specificity (d/d+b), positive (a/a+b) and negative predictive values (d/c+d) were calculated to find the reliability of ultrasonography in detecting genital tract abnormalities by comparing with macroscopy (Hanzen *et. al.,* 2000). In the above calculations, the letters a, b, c and d respectively indicate the number of true positive, false positive, false negative, true negative diagnoses made by ultrasonoraphy.

Out of total 505 buffalo genital tracts examined grossly, 53.7 percent had abnormalities (Table 1). Compared to bilateral, the incidence of unilateral genital abnormalities were significantly ($p<0.01$) higher. However, no difference was observed between the incidence of abnormalities on the right or left side of genitalia, in accordance with previous findings in cattle (Al-Dahash and David 1977).

Follicular cyst:

The observed incidence (Table 1) of follicular cyst was less compared to similar studies in cattle and buffaloes (3.3-5.9%; Sharma *et. al.,* 1993, Chaudhari and Paul, 2000). Gross diameter of follicular cysts varied between 25.4-34.3mm (Fig. 1). Ultrasonographically, these had anechoic antrum and smooth thin wall (Fig. 1) in accordance with *in vivo* findings in cattle (Farin *et. al.*, 1990).

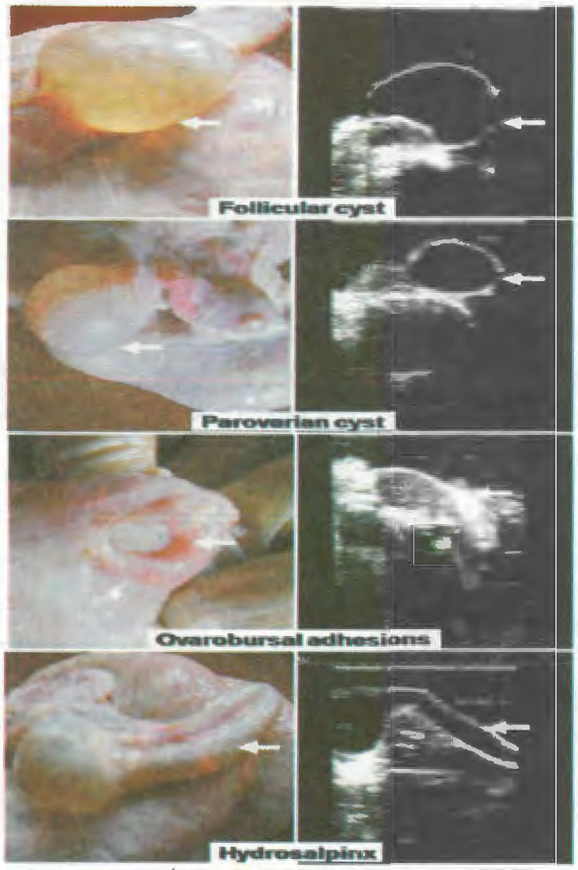

Fig 1. Photographs (left) and sonograms (right) of ovarian and fallopian tube abnormalities in buffalo genitalia

As indicated by 100 percent sensitivity, specificity and predictive values (Table 2), ultrasonography correctly diagnosed all the buffalo genitalia which were grossly confirmed to be either with or without follicular cysts. These values were higher compared to previously reported (82, 87 and 90%, respectively) for *in vivo* ultrasonographic diagnosis of follicular cysts in cattle (Farin *et. al.,* 1990).

Luteal cyst:

It was not found in any of the genital tracts obtained from slaughtered buffaloes (Table 1) which is in agreement with a previous study based on 240 buffalo genital tracts (Sharma *et. al.*, 1993). However, incidence of luteal cysts in cattle has been reported between 2.3-10 per cent (Kubar and Jalakas, 2002).

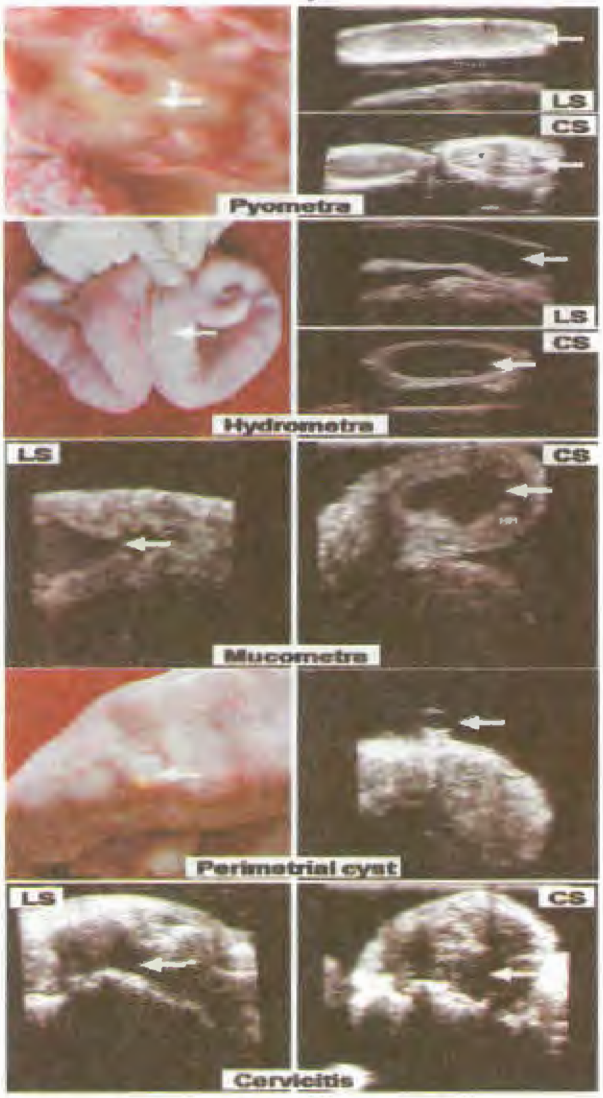

Fig 2. Photographs and sonograms of uterine and cervical abnormalities in buffalo genitalia. LS: Longitudinal section, CS: Cross section

Parovarian cyst:

The observed incidence of parovarian cyst (Table 1) is in agreement with previous abattoir findings in cattle and buffaloes (Khan *et. al.*, 1989, Wahid *et. al.*, 1991). Grossly, cysts appeared as spherical translucent vesicles on the broad ligaments with diameter between 3.2-27.6 mm (Fig. 1). Ultrasonographically, cysts were anechoic fluid filled areas with smooth thin walls (Fig. 1). As indicated by sensitivity values (Table 2), more than 85 per cent of the grossly observed cysts were correctly diagnosed by ultrasonography. Specificity values (Table 2) suggested that ultrasonography correctly diagnosed grossly confirmed absence of parovarian cysts in all buffalo genitalia. The predictive values (Table 2) revealed that more than 99 percent positive and negative diagnoses made by ultrasonography were correct.

Ovarobursal adhesion:

The incidence of ovarobursal adhesions observed (Table 1) in the present study is in agreement to previous abattoir studies in cattle and buffaloes (Sharma *et. al.*, 1993, Chaudhari and Paul, 2000). Grossly, severity of adhesions ranged from moderate strands of connective tissue between bursa and ovary to severe adhesions where ovary was completely embedded in fibrous tissue (Fig. 1). Ultrasonographically, adhesions were hyperechogenic bands around ovaries (Fig. 1) in accordance with *in vivo* results in buffaloes (Honparkhe, 2001). Ultrasonography correctly diagnosed not only more than 89 percent (sensitivity, Table 2) of grossly confirmed cases of adhesions but also diagnosed all (specificity, Table 2) the grossly confirmed cases for the absence of ovarobursal adhesions. All the positive and negative diagnoses made for ovarobursal adhesions were correct (Table 2).

Hydrosalpinx:

Unilateral hydrosalpinx observed in the buffalo genitalia (Table 1) is similar to that reported in slaughtered cattle (Chaudhari and Paul, 2000). Macroscopically, fallopian tube of the affected side was distended and filled with colorless or yellow fluid (Fig. 1). With ultrasonography, affected fallopian tube appeared distended with an anechoic fluid (Fig. 1). Ultrasonography correctly diagnosed all the genitalia which were grossly confirmed to be either with or without hydrosalpinx (Table 2).

Non-patent fallopian tubes:

Incidence of non-patent fallopian tubes found in the genitalia of slaughtered buffaloes (Table 1) is similar to previous findings in bovines

(Dwivedi and Singh, 1971, Kelly *et. al.*, 1981). With ultrasonography, it was not possible to detect blocked fallopian tubes due to their narrow lumen.

Pyometra:

A low incidence of pyometra was observed in the present study (Table 1) in line with previous reports in buffaloes (Khan *et. al.* 1989). Grossly, uteri were distended with pus which had thin consistency in two uteri and thick in the remaining two (Fig. 2). Ultrasonography revealed the accumulation of a hyperechogenic fluid within the uterine lumen (Fig. 2). When the uterine contents were thick, the echogenicity closely resembled to uterine wall. One case of pyometra was wrongly identified as mucometra due to consistency of pus which closely resembled to mucus. Sensitivity, specificity, and positive and negative predictive values of ultrasonography for the diagnosis of grossly confirmed cases of pyometra were 75, 100, 100 and 99.8 percent, respectively (Table 2), in accordance with *in-vivo* ultrasonography results in buffaloes (Honparkhe, 2001, Ali and Abdel-Razek, 2002).

Hydrometra:

Incidence of buffalo genitalia confirmed for hydrometra in the present study (Table 1) was similar to previous abattoir study in buffaloes (Kumar, 1981). Uteri were filled with watery and clear anechogenic fluid (Fig. 2) in accordance with previous findings in buffaloes (Ali and Abdel-Razek, 2002). Ultrasonography correctly diagnosed all the genitalia either with or without hydrometra (Table 2).

Mucometra:

Incidence of mucometra in the genitalia of slaughtered buffaloes (Table 1) was similar to those reported in the genitalia of slaughtered cattle (Al-Dahash and David, 1977). Macroscopically, uterine wall was thin and lumen was filled with clear mucoid fluid in accordance with previous findings (Sane *et. al.*, 1982). Ultrasonographically, uterine lumen had hypoechogenic fluid (Fig. 2), with echogenicity in between hydrometra and pyometra. Ultrasonography correctly diagnosed almost all the uteri with and without mucometra (sensitivity and specificity values, Table 2). Positive diagnosis made for mucometra was correct in half of the cases, whereas negative diagnosis was correct in all the cases (Table 2).

Perimetrial cyst:

In the present study, only 0.2 percent buffalo genitalia had perimetrial cyst (Table 1). Although many abattoir studies have observed endometrial cysts but there is no report of perimetrial cysts. The size of perimetrial cyst encountered in the present study was too small to interfere with fertility. Macroscopically, cyst was located on the external surface of uterus which ultrasonographically appeared as anechoic fluid filled structure with smooth and thin wall (Fig. 2). Ultrasonography correctly diagnosed the presence of perimetrial cyst (sensitivity, Table 2) and further confirmed the absence of cysts in buffalo genitalia as seen grossly (specificity, Table 2). Positive and negative diagnoses made for perimetrial cyst were also correct (Table 2).

Cervicitis:

Occurrence of cervicitis in buffalo genitalia (Table 1) was similar to that found in slaughtered buffaloes (Sane *et. al.*, 1982). Grossly, cervix contained mucopurulent exudate which was ultrasonographically characterized by collection of hypoechogenic fluid between the cervical rings (Fig. 2) in agreement with the findings in buffaloes (Ali and Abdel-Razek, 2002). Ultrasonography was not accurate in diagnosing cervicitis in buffalo genitalia (sensitivity, Table 2). High specificity indicated that all the genitalia without cervicitis as confirmed grossly were also correctly diagnosed by ultrasonography (Table 2). In conclusion, overall high sensitivity (88%) and positive predictive values (99%; Table 2) of ultrasonography for confirmation of grossly detected genital tract abnormalities (excluding non patent-fallopian tubes), indicated that ultrasonography is a highly reliable tool for the correct diagnosis of buffalo genital tract abnormalities (excluding non-patent fallopian tubes).

Table 1: Incidence of abnormalities in the genitalia of slaughtered buffaloes (n=505).

Abnormality	Total	Unilateral		Bilateral*
		Right	Left	
Follicular cyst	11 (2.2)	6 (1.2)	4 (0.8)	1 (0.2)
Luteal cyst	0 (0.0)	0 (0.0)	(0.00)	(0.00)
Parovarian cyst	40 (7.9)	17 (3.4)	20 (3.9)	3 (0.6)
Ovarobursal adhesion	14 (2.8)	6 (1.2)	3 (0.6)	5 (1.0)
Hydrosalpinx	4 (0.8)	3 (0.6)	1 (0.2)	0 (0.0)
Non-patent fallopian tubes	191 (37.8)	75 (14.9)	66 (13.1)	50 (9.9)
Pyometra	4 (0.8)	-	-	-
Hydrometra	2 (0.4)	-	-	-
Mucometra	1 (0.2)	-	-	-
Perimetrial cyst	1 (0.2)	-	-	-
Cervicitis	3 (0.6)	-	-	-
Total genital tract abnormalities	271 (53.7)	-	-	-

Figures in parenthesis indicate percentage
*p<0.01; Unilateral incidence is significantly more than bilateral

Table 2: Sensitivity, specificity and predictive values of ultrasonography in detecting various grossly confirmed abnormalities in the genitalia of slaughtered buffaloes (n=505)

Abnormality	Number of genital tracts detected with abnormalities					Sensitivity (%)	Specificity (%)	Positive predictive value (%)	Negative predictive value (%)
	Gross	Ultrasound							
		True positive	False positive	False negative	True negative				
Follicular cyst	12	12	0	0	998	100	100	100	100
Parovarian cyst	49	42	0	7	967	85.7	100	100	99.3
Ovarobursal adhesion	19	17	0	2	991	89.5	100	100	99.8
Hydrosalpinx	4	4	0	0	1006	100	100	100	100
Pyometra	4	3	0	1	501	75	100	100	99.8
Hydrometra	2	2	0	0	503	100	100	100	100
Mucometra	1	1	1	0	503	100	99.8	50.0	100
Perimetrial cyst	1	1	0	0	504	100	100	100	100
Cervicitis	3	2	0	1	502	66.7	100	100	99.8
Overall	95	84	1	11	-	88.4	-	98.8	-

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