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RELATIVE ACCURACY OF THE IDENTIFICATION OF OVARIAN STRUCTURES IN THE COW BY ULTRASONOGRAPHY AND PALPATION PER RECTUM

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1. Introduction

In the reproductive management of dairy and beef cattle, it is desirable to have heifers calving at 24 months of age, and to maintain the number of days open at 100 or less. To meet these goals, veterinarians should examine cows that have not been observed in oestrus after insemination at an early time to confirm the absence of pregnancy. Palpation of the reproductive tract is the most common approach to pregnancy diagnosis, as opposed to the use of a progesterone assay or ultrasonography. It is important to differentiate between non-cyclical (true anoestrus) and cyclic cows that have not been detected in oestrus. The latter is a prerequisite to the rational use of treatment aimed at synchronization of oestrus and for fixed time insemination (Eddy, 1977; Thatcher et al., 1997).

Early pregnancy diagnosis is also important in reproductive management in order to rebreed the non-pregnant animals as soon as possible. Treatment for cystic ovarian degeneration largely depends on accurate diagnosis (Dobson & Nanda, 1992). An accurate examination of the reproductive tract per rectum is also necessary to a synchronization programme (Hardin, 1984). Finally, it is important to assess the effect of the superovulatory treatment by estimating the number of corpora lutea and anovulatory follicles before attempting non-surgical collection of embryos.

The foregoing shows the importance of the accurate transrectal palpation. This review compares the potential and the limitations of transrectal palpation of the reproductive tract with that the determination of milk or plasma progesterone levels determination, ultrasonography and direct examination of the ovaries after slaughter.

2. Palpable and ultrasonographical characteristics of physiological and pathological ovarian structures

Bovine ovaries are spherical or oblong structures measuring 2 to 5 cm in length, 1.5 to 4 cm in height, and 1.5 to 3 cm in width. Follicles and corpora lutea are normal physiological structures whereas follicular or luteal cysts, and less frequently adhesions, parovarian cysts, abscesses and tumors, are abnormal.

2.1. Physiological structures - palpable characteristics

During prooestrus and oestrus, the normal palpable follicle is a round, smooth structure with a fairly firm consistency with a diameter ranging from 7 to 20 mm. Except for nulliparous heifers the follicle generally represents only a small portion of the ovary. Fluctuations can be palpated and a ovulation approaches the follicle becomes soft. The increased tone of the uterus and the presence of mucus aid in recognizing these stages of the oestrous cycle. By retraction of the cervix and compression of the vagina, mucus can be expelled from the vagina. Put-tinged mucus usually indicates some degree of vaginal, cervical or uterine infection. Watery mucus may be seen in cows with cystic follicles. Slightly opaque, thick, tenacious mucus is most commonly seen around day 17 to 18 of the oestrous cycle, or in animals that are ready to calve.

After ovulation, during metaoestrus, the collapsed follicle is palpable as a depression but contains very little blood compared to that of the mare. Unless a cow has been palpated daily and the examiner knows exactly where the follicle was located, the ovulatory depression may be difficult to recognize, especially more than 12 hours after ovulation. When the ovulatory depression cannot be palpated, the ovaries can be classified as NSO (no structures on the ovaries); and at this time there will be uterine tone due to oedema. In addition, the mucus may be blood-tinged and not as cohesive as during oestrus. The corpus haemorrhagicum (developing, growing, young corpus luteum) is present from day 1 to day 5. It is rather difficult to identify, especially in the early stages. A soft papilla < 1 cm in height can be felt as a crepitant structure and can be differentiated from a follicle because its surface is less firm and smooth, and it is smaller than either a mature follicle or a mature corpus luteum.

During dioestrus the mature corpus luteum reaches a maximum size of 20 to 30 cm between days 6 and 18 after ovulation. The consistency has been described as “liver-like” (Zemjanis, 1970; Studer, 1975; Belling, 1986). An ovulation papilla or crown protrudes from the surface of the ovary. At the stage of maximum development, the corpus luteum often occupies more space than the remainder of the ovarian tissue and has a clean outline. Follicles can generally be palpated in the presence of the corpus luteum. The uterus is pliable but not firm, and mucus cannot be expressed from the vagina. The corpus luteum of pregnancy is rounded and embedded in the ovary. Sometimes, it feels more rounded and smooth than the cyclical corpus luteum. A persistent corpus luteum is never observed except in pregnancy or where there are uterine lesions such as pyometra or congenital segmental hypoplasia (e.g. uterus unicornis). Corpora lutea with a fluid filled central cavity (lacuna) have been observed in an average 30 % of slaughter specimens (McEntee, 1958), by transrectal palpation (Morrow et al., 1966, Donaldson & Hansel, 1968; Kaneda, 1980) and by ultrasonography (Kito et al., 1986; Pierson & Ginther,
1987, Kastelic et al., 1990a). The regressing corpus luteum at day 18 becomes increasingly firm (Zemjanis, 1970; Studer, 1975) and can be palpated until 1 to 3 days after the next ovulation. From then on, it is referred to as a corpus albicans.

2.2. Physiological structures - ultrasonographical features

Regardless of the stages of the oestrous cycle or the day post partum, follicles can readily be distinguished by ultrasonography (Pierson & Ginther 1984a, 1988a; Edmondson et al., 1986; Kahn & Leidl, 1989; Pieterse, 1989). They appear as dark, sometimes delineated, anechogenic structures, surrounded by a fine wall and with a diameter usually < 25 mm. Due to lack of attenuation of the ultrasound wave, an hyperechogenic border is usually seen at the distal zone of the follicle. Ultrasonography will however only show the follicular cavity, thus the real diameter of the follicle is often underestimated by 2 to 3 mm (Quirk et al., 1988). Nevertheless, there is a strong correlation between anatomical and ultrasonographic measurements for follicles with a diameter > 3 mm (Pierson & Ginther, 1987). According to Pierson and Ginther (1984a) and Edmondson et al. (1986) it is possible to detect follicles with a diameter ≥ 6 mm with a 3.5 MHZ transducer and follicles with a diameter ≥ 2 mm with a 5 MHz transducer. Follicles < 5 mm can be confused with cross sections of ovarian blood or lymph vessels (Pieterse, 1989). Precise counting of 2 to 5 mm follicles by ultrasonography is very inaccurate (Pieterse et al., 1990). The presence of several follicles or a corpus luteum can cause compression of the follicles making them appear irregular in outline (Pierson & Ginther, 1988b).

During metestrus, ovulation can be indirectly detected with ultrasonography by the disappearance of the preovulatory follicle or by its quick decrease in size (Pierson & Ginther, 1984a, 1988a). It is possible to detect the corpus haemorrhagicum with a 5 MHz transducer on the first day after oestrus although the routine examination usually takes place between days 3 and 5 after ovulation (Kastelic et al., 1990a). The developing corpus haemorrhagicum is a poorly delineated, irregular, greyish-black structure with several echogenic spots within the ovary. A crown-like ovulatory papilla is occasionally seen (Pierson & Ginther 1984a; Omran et al., 1988, Edmondson et al., 1986; Pieterse, 1989; Kastelic et al., 1990a; Ribadu et al., 1994).

The echogenicity of luteal structures increases during dioestrus. A mature corpus luteum appears as a greyish echogenic area with a line of demarcation visible between it and the ovarian stroma. The ultrasonographic appearance of the corpus luteum is very similar in pregnant and non-pregnant animals (Pierson & Ginther, 1984a; Omran et al., 1988; Edmondson et al., 1986; Pieterse, 1989; Kastelic et al., 1990a; Ribadu et al., 1994) and is impossible to distinguish a particular day of dioestrus (Pieterse, 1989). According to a number of studies (Kito et al., 1986; Pierson & Ginther 1987; Kastelic et al., 1990a), the ultrasound appearance of the central cavity of a fluid filled corpus luteum can be similar to that of a follicle (Kahn & Leidl, 1989). Usually, it is less regular, surrounded by luteal tissue, rounded and presents more highly echogenic bands or echogenic spots corresponding respectively to fibrin-like strands and accumulations of haemolyzed blood (Pierson & Ginther, 1987). The central cavity, or lacuna, of the corpus luteum may have a diameter of between 2 and 22 mm. According to Kito et al. (1986), 31% and 24% of these lacunae have a diameter of 7 to 9 mm, or of 10 mm or more, respectively. Kastelic et al. (1990a) reported that 35% of these cavities have a diameter > 10 mm, with 52% ranging from 6 to 10 mm, and 13% from 2 to 5 mm with no difference between pregnant and non-pregnant animals. This cavity may regress or persist through the cycle. Generally, the diameter is greatest on day 10 after ovulation, regardless of the maximum diameter (Kastelic et al., 1990b), with the largest cavities detectable for a longer period of time. Cavities > 10 mm take more than 21 days to disappear (Kito et al., 1986). On average, smaller cavities regress within one week. Some authors have observed such cavities to persist until 20 or even 40 days of pregnancy (Kito et al., 1986; Kastelic et al., 1990a). In non-pregnant animals, the amount of luteal tissue is independent of the diameter of the lacuna. But in pregnant animals, the area of luteal tissue is considerably greater in the presence of a large cavity (>80 sq mm) as compared with a small (3 to 20 sq mm) or a medium (21 to 80 sq mm) sized one (Kastelic et al., 1990a). The presence or the size of the cavity has no influence on serum progesterone concentration (Ribadu et al., 1994, Kito et al., 1986, Quirk et al., 1986, Kastelic et al., 1990b), or on the delay of the return to oestrus, (Kaneda et al., 1980; Kito et al., 1986), or on the potential of the animal to become pregnant. Moreover there is also no tendency for a cavity to recur from one cycle to another in the same animal (Kito et al., 1986; Kastelic et al., 1990a).

In a regressing corpus luteum, the line of demarcation is faint due to the slight difference in echogenicity between tissues (Pierson & Ginther, 1984a; Kastelic et al., 1990a).

2.3. Pathological structures : ovarian cysts

A cyst is a fluid-filled space > 25 mm in diameter in an ovary that can persist for more than 10 days in the absence of a corpus luteum (Bierschwal et al., 1975; Seguin, 1980). The infrequent presence of a cyst-like structure in conjunction with a corpus luteum is usually non-pathological. The two types of ovarian cysts are the
follicular and the luteal cyst. Based on progesterone concentrations or dissection of ovaries in different studies, the occurrence of luteal cysts ranges from 30 to 76% of cases (Zemjanis, 1970; Al-Dahash et al., 1977; Dobson et al., 1977; Farin et al., 1992).

On transrectal palpation follicular cysts have a thin wall, feel fluctuant, and are likely to rupture during manipulation. Luteal cysts on the other hand, have a thicker wall made up of luteal tissue, which makes them feel firmer. The mean plasma progesterone concentration of a cow with a luteal cyst has been reported to be 3.6 ng/mL (Ribadu et al., 1994) with a range from 3.0 to 10.4 ng/mL (Leslie & Bosu, 1983). These values are similar to values reported during the luteal phase of the oestrous cycle.

The follicular cyst presents the same ultrasonographic characteristics as a follicle. Its diameter is > 25 mm and the thickness of the wall < 3 mm (Edmondson et al., 1986; Carroll et al., 1990). Its configuration is spherical, oval or polygonal depending on the relative pressure exerted by other structures on the ovary (Kahn & Leidl, 1989). The spherical shape is usually seen when there is only one cyst. Follicular cysts are anechogenic. As for the follicle, a hyperechogenic zone can be seen at the distal wall of the luteal cyst due to the presence of luteal tissue. Some authors have proposed to base the differential diagnosis between a follicular and a luteal cyst on the thickness of the cyst wall, whereby the thickness of the wall of a follicular cyst is ≤ 3 mm, and the thickness of the wall of a luteal cyst is > 3 mm (Edmondson et al., 1986; Carroll et al., 1990). The anechogenic cavity sometimes presents additional echogenic strings (Pieterse, 1989).

Differential diagnosis between a corpus luteum with a cavity and a luteal cyst can be based on the following criteria (Kahn & Leidl, 1989):
- the lacuna of the corpus luteum usually has a diameter of less than 25 to 30 mm;
- the thickness of the surrounding luteal tissue ranges from 5 to 10 mm;
- the cavity of a luteal cyst is usually regular and often shows some thin white lines (trabeculae);
- the edge of the luteal tissue is less regular than that of a follicle (Pieterse, 1989);
- luteal tissue usually is wider than the cavity.
- the lacuna of the corpus luteum tends to regress after day 10 of the oestrous cycle (Kastelic et al., 1990a).

3. Comparison of diagnostic methods for ovarian structures

The reliability of the diagnostic method and the accuracy of the diagnosis can be evaluated by using a 2x2 table for which data have to be obtained for all four cells (Smith, 1991; Table I).

Two parameters are traditionally used to describe the characteristics of a particular diagnostic method. The sensitivity (Se) can be defined as the likelihood of a positive test result in animals known to have a particular normal or abnormal ovarian structure. For example, for a population of cows, sensitivity can determine the percentage of animals with a corpus luteum determined by a certain diagnostic method. An equation describing the sensitivity is: a/(a+c)x100.

Conversely, the specificity (Sp) is defined as the likelihood of a negative test result in animals known to lack the particular structure and is giving the equation d/(d+b)x100.

Although the sensitivity and specificity of the diagnostic method are important, practitioners should be more concerned with the predictive value of a diagnostic method, i.e. the probability that the diagnosis accurately reflects the true ovarian status. The positive predictive value (+PV) would then be the probability of the presence of an ovarian structure in an animal i.e a/(a+b)x100 and the negative predictive value (-PV) being the probability that an animal does not have the particular ovarian structure as diagnosed correctly by the clinician i.e d/(c+d)x100.

Table I : Outcome of Diagnostic Tests

<table>
<thead>
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<th>Diagnosis</th>
<th>Positive</th>
<th>Negative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td>a (true positive)</td>
<td>b (false positive)</td>
</tr>
<tr>
<td>Negative</td>
<td>c (false negative)</td>
<td>d (true negative)</td>
</tr>
</tbody>
</table>

3.1. Diagnosis of follicles

Diagnosis of follicles < 10 mm by palpation per rectum can be inaccurate, and may depend on the overall size of the ovary, the degree of relaxation of the rectal wall, body score of the animal, and the skill of the examinor. In
one study, 22 to 28% of follicles of at least 10 mm were detected by palpation, whereas ultrasonography detected 76 to 89% of the follicles actually present (Pieterse et al., 1990; Ribadu et al., 1994). The diagnosis of a follicle > 10 mm is more accurate by ultrasonography than by palpation (Kahn & Leidl, 1986; Table II; Pieterse et al., 1990).

Ultrasonographic determination of the presence of follicles < 5 mm is difficult with a 5 MHz probe (Pieterse et al., 1990). Accuracy can be improved by using a 7.5 MHz transducer or by analyzing video recordings (Quirk et al., 1986; Siros & Fortune, 1988). Ultrasonography is capable of detecting 34% of follicles with a diameter of between 5 and 10 mm (Pieterse et al., 1990), and is more accurate than palpation (Kahn & Leidl, 1986). Compared with palpation, ultrasonography offers the advantage of being able to measure the inner diameter of the follicle. Some authors obtained an 80 to 97% correlation between diameters measured with a 5 MHz transducer and those obtained with a microscope (Pierson & Ginther, 1987).

3.2. Diagnosis of luteal structures

The presence and number of luteal structures, or their absence, can be determined by palpation, and their functional status implied by size and consistency. Inability to detect functional luteal tissue could result in failure to treat a significant number of cows capable of responding to a luteolytic agent.

The predictive values of the presence or absence of a corpus luteum as determined by palpation have been quite similar in several studies in which determination of progesterone concentrations was compared with palpation per rectum (78% (range 76 to 90), versus 75% (range 61 to 94) respectively: Table III). Conversely, the sensitivity is greater (92%, range 71 to 90) than the specificity (65%, range 50 to 96) (Boyd & Munro, 1979; Watson & Munro, 1980; Mortimer et al., 1983; Ott et al., 1986; Pathiraja et al., 1986; Kelton et al., 1988; 1991; Ribadu et al., 1994).

Compared with the dissection of ovaries collected at slaughter, the accuracy of palpation for the presence of a mature corpus luteum has reported as 86% (Kahn & Leidl, 1986; Pieterse et al., 1990; Table II). Using the same methods of comparison, the accuracy of determining the absence of a corpus luteum by palpation per rectum was 85% (Pieterse et al., 1990). Regression of the corpus luteum is difficult to ascertain by palpation with a positive predictive value of 64% (Pieterse et al., 1990). Other studies confirmed that it is easier to determine the presence rather than the absence of the corpus luteum. The diagnosis of the presence of a corpus luteum of a size > 1 cm appears to be accurate in 89% (125/141) of cases. Of 61 cases of missed diagnoses, 44.4% of follicles > 7.5 mm and 15% of corpora lutea > 10 mm were not detected. Moreover, 10% of the corpora lutea were mistaken for follicles or cysts (Dawson, 1975). In a similar study, 40% of 81 errors reported after palpation were contributed to undetected corpora lutea, 17% to corpora lutea identified as follicles, and 16% to incorrect assessment of the status of the corpora lutea (El-Wishy & Ghoneim, 1995). Others (Landsverk & Kalberg, 1988) correctly classified the ovaries as prooestrous, oestrous, metaoestrous and dioestrous in 54, 60, 72 and 90% of cases, respectively. Similar results were obtained by other authors (El-Wishy & Ghoneim, 1995) who correctly classified 242 ovaries as prooestrous, oestrous, metaoestrous and dioestrous in 71, 71, 41 and 85% of cases, respectively.

Compared to dissection, the positive predictive value of a mature corpus luteum diagnosed by ultrasonography (CL2, Table IV) is lower (87%) than the negative predictive value (92%). (Kahn & Leidl, 1986; Pieterse et al., 1990; Ribadu et al., 1994). The correct diagnosis of a corpus haemorrhagicum by ultrasonography (positive predictive value 33%) or regressing corpus luteum (positive predictive value 57%) is difficult (Pieterse et al., 1990).

Collectively, the studies show that the positive and negative predictive values obtained by ultrasonography are higher than those obtained by palpation. With either method it is difficult to diagnose a growing or a regressing corpus luteum. The difficulty to detect a corpus haemorrhagicum by palpation is due to its relatively small size and soft consistency. A corpus haemorrhagicum is also poorly echogenic. Conversely, identification of old (regressing or regressed) corpus luteum is slightly, although not significantly, better by palpation than by ultrasonography (Pieterse et al., 1990) because the echogenicity of such firm corpora lutea resembles that of ovarian stroma. Differences may further be attributed to types of transducers (5.0 vs 7.5 MHZ), the approach (transrectal vs transvaginal) and the subjectivity of the operators.

3.3. Number of corpora lutea

Accurate estimation of the number of corpora lutea is difficult when the number exceeds five or six, or when follicles are simultaneously present. In a study of 20 cows superovulated with eCG, the number of corpora lutea was significantly underestimated by palpation when more than nine corpora lutea were present. Transrectal palpation also failed to correctly identify the number of follicles > 10 mm when there were more than four follicles present (Guay & Bedoya, 1981).
3.4. **Size of the corpus luteum**

Determination of the size of the corpus luteum can be important. Indeed, it has been reported that the corpus luteum is largest at the period of maximal luteal function (Stabenfeldt et al., 1969; Shemesh et al., 1971). Moreover, a decrease in the size of the corpus luteum coincides with decrease in the plasma progesterone concentration (Quirk et al., 1986). Diameters of mature corpora lutea range from 19 to 35 mm (Roberts, 1986) and weights from 2.17 to 8.86g (Ribadu et al., 1994). It is easier to measure the surface area, hence the size, of the corpus luteum by ultrasonography than to estimate it by transrectal palpation. The size of the corpus luteum determined by ultrasonography is strongly correlated ($r= 0.68$ to $0.85$) to milk progesterone concentrations (Sprecher et al., 1989; Rajamahendran & Taylor, 1990; Ribadu et al., 1994). A luteal structure $> 11$ mm usually correlates with a progesterone concentration greater than $5$ ng/mL (Sprecher et al., 1989). Nevertheless, such a correlation appears to depend on the reproductive status of the animal. Thus, a strong and significant correlation exists between the surface area of the luteal tissue and plasma concentration during the first half of the oestrous cycle in non-pregnant animals ($r=0.73$) and in animals who become pregnant ($r=0.85$). A similar correlation exists during the second half of the cycle only in non-pregnant animals ($r=0.77$) but for unknown reasons, has not been observed for heifers who become pregnant following that cycle ($r=0.33$) (Kastelic et al., 1990b). It has also been demonstrated that, after luteolysis, physical regression of the corpus luteum is slower than the decrease in progesterone production. The surface area of the image of the corpus luteum on ultrasonography decreases daily by 20% and the progesterone concentration is reduced by 28% (Kastelic et al., 1990b). Finally, there is also a linear relationship between the weight of the mature corpus luteum and plasma progesterone concentration ($r=0.87$) (Ribadu et al., 1994). Similar correlations have not been observed with transrectal palpation (Watson & Munro, 1980; Mortimer et al., 1983).

3.5. **Consistency of the corpus luteum**

Consistency of the corpus luteum can only be evaluated by palpation. A positive correlation has been reported between the soft corpus haemorrhagicum and the firm regressing corpus luteum as determined by palpation and plasma progesterone concentrations. Such a correlation is not significant for the mature corpus luteum and there is no correlation between the size of the corpus luteum and its consistency. Collectively these studies show that determination of consistency has limited value for assessing the functional status of the corpus luteum (Watson & Munro, 1980).

3.6. **Diagnosis of cysts**

A definitive differential diagnosis between follicular and luteal cysts can be helpful. Treatment of luteal cysts with prostaglandin (PG) F2α results in a shorter interval to the next oestrus than treatment with either gonadotropin releasing hormone alone or treatment with gonadotropin releasing hormone followed by prostaglandin PGF2α nine days later (Kesler et al 1978; Dinsmore et al., 1989).

The accuracy of palpation or ultrasonography for the diagnosis of an ovarian cyst can be confirmed by measuring peripheral plasma progesterone concentration and a wide range of concentrations has been reported (Table V). On average, the positive predictive values for follicular cysts diagnosed by palpation (Dobson et al., 1977; Sprecher et al., 1989; Farin et al., 1992) or by ultrasonography (Carroll et al., 1990; Farin et al., 1992) are 66% (range 39 to 78) and 74% (range 60 to 78), respectively. Conversely, the positive predictive value for luteal cysts diagnosed by palpation (Dobson et al., 1977; Sprecher et al., 1989; Carroll et al., 1990; Farin et al., 1992) or by ultrasonography (Carroll et al., 1990; Farin et al., 1992) are 66% (range 35 to 87) and 85% (range 50 to 90), respectively. Variations observed between different studies may be due to the frequency of the transducer used, but also to the considerable variation in the patterns of luteal cysts (Carroll et al., 1990) or in the density of luteal tissue which range from an irregular pattern to a fairly well defined border (Al-Dahash et al., 1977; Farin et al., 1992). In a luteal cyst, the luteal tissue can be accompanied by a low concentration of plasma progesterone (Carroll et al., 1990). Differences between clinicians are not a common feature although there is more agreement between diagnosis of luteal cysts than of follicular cysts (Farin et al., 1992).

The use of on-farm milk progesterone kits do not appear to improve the accuracy of diagnosis by palpation (Dobson & Nanda, 1992). However, the combined use results in a higher predictive value, specificity and sensitivity than reliance on palpation alone (Sprecher et al., 1988). In a separate study, the presence and the type of ovarian cysts was correctly diagnosed in 52% of the cases and the ultrasonographic classification was accurate in 93% (Ribadu et al., 1994). Based on milk progesterone concentration (Nakao et al., 1983), the follicular cysts can be correctly diagnosed by manual palpation in 65% of the time. Nineteen percent of luteal cysts and 16% of corpora...
lutea with lacunae were incorrectly diagnosed as follicular cysts (Nakao et al., 1983).

4. Conclusions

Veterinarians involved in the management of bovine reproduction are frequently asked to assess ovarian status. They must be able to differentiate between physiological and pathological structures on the ovary and for accurate diagnosis, the size of the ovaries and the tone of the uterus have to be evaluated in relationship to the day post partum and the stage of the oestrous cycle. In addition, veterinarians must have the reproductive history of the animal(s) including oestrus detection, progesterone profiles, and observations made by the farmer and/or the veterinarian, as well as ultrasonographic findings. Each practitioner can improve his or her tactile skills with the aid of the supplemental information and the use of slaughter specimens has been found to be very useful for improving palpation and scanning skills. Large individual variations in size and consistency of ovarian structures make for difficult differentiation if the diagnosis is based on a single examination. In these cases, sequential examination will improve the accuracy of the diagnosis which may be further enhanced by the use of other modalities including ultrasonography and determination of progesterone concentrations.

5. Références


6. Tables

Table II
Predictive values (+ PV) of manual palpation and ultrasonography (E) for predicting the presence of follicles smaller (F<) or larger (F>) than 10 mm compared to dissection (D) of ovaries

<table>
<thead>
<tr>
<th>N</th>
<th>MHz</th>
<th>a</th>
<th>b</th>
<th>+ PV</th>
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<tbody>
<tr>
<td>25</td>
<td>MP</td>
<td>7</td>
<td>18</td>
<td>28 Ribadu et al. (1994)</td>
</tr>
<tr>
<td>274</td>
<td>MP</td>
<td>59</td>
<td>215</td>
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</tr>
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<td>67</td>
<td>MP</td>
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<tr>
<td>274</td>
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<td>94</td>
<td>180</td>
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<td>19</td>
<td>6</td>
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</tr>
<tr>
<td>67</td>
<td>E</td>
<td>64</td>
<td>8</td>
<td>89 Pieterse et al. (1990)</td>
</tr>
</tbody>
</table>

a: presence of follicle correct; b: presence of follicle incorrect

Table III
Sensitivity (Se), specificity (Sp) and predictive (+ PV, - PV) values of manual palpation (MP) for predicting the presence of growing (CL1), mid-cycle (CL2 or regressing CL3) corpus luteum compared to progesterone evaluation (P) or dissection (D) of ovaries

<table>
<thead>
<tr>
<th>N</th>
<th>a</th>
<th>b</th>
<th>c</th>
<th>d</th>
<th>+ PV</th>
<th>- PV</th>
<th>Se</th>
<th>Sp</th>
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<td>9</td>
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<td>E vs D</td>
<td>CL1</td>
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<td>33</td>
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<td>36</td>
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<td>E vs D</td>
<td>CL2</td>
<td>29</td>
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<td>13</td>
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<td>E vs D</td>
<td>CL2</td>
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<td>E vs D</td>
<td>CL2</td>
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<td>E vs D</td>
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<td>4</td>
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Table IV
Sensitivity (Se), specificity (Sp) and predictive values (+ PV, - PV) of diagnosis of the absence (CL0) or the presence of growing (CL1), mid-cycle (CL2 or regressing (CL3) corpus luteum made by ultrasonography (E) compared to dissection (D) of ovaries.

a : presence of corpus luteum correct; b: presence of corpus luteum incorrect

c: absence of corpus luteum correct; d absence of corpus luteum incorrect
Table V
Sensitivity (Se), specificity (Sp) and predictive values (+ PV, - PV) of diagnosis of follicular and luteal cysts made by manual palpation (MP) or ultrasonography (E) compared to progesterone test (P)

<table>
<thead>
<tr>
<th>N</th>
<th>MHz</th>
<th>a</th>
<th>b</th>
<th>c</th>
<th>d</th>
<th>+ PV</th>
<th>- PV</th>
<th>Se</th>
<th>Sp</th>
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<td>13</td>
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<td>66</td>
<td>66</td>
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<tr>
<td>47</td>
<td>E vs P</td>
<td>14</td>
<td>4</td>
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<tr>
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<td>E vs P</td>
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<td>2</td>
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<td>60</td>
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</tbody>
</table>

| **Luteal cysts** |     |    |    |    |    |      |      |     |     |
| 89 | MP vs P | 13 | 24 | 13 | 39 | 35   | 75   | 50  | 62  |
| 10 | MP vs P | 4  | 6  |    |    | 40   |      |     |     |
| 68 | MP vs P | 59 | 9  |    |    | 87   |      |     |     |
| 47 | MP vs P | 13 | 6  | 11 | 39 | 68   | 43   | 65  | 65  |
| 4  | E vs P  | 2  | 2  |    |    | 50   |      |     |     |
| 47 | E vs P  | 26 | 3  | 4  | 14 | 90   | 78   | 87  | 82  |

a: presence of ovarian cyst correct; b: presence of ovarian cyst incorrect

c: absence of ovarian cyst correct; d: absence of ovarian cyst incorrect