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Post-ovariohysterectomy Colposuspension to Prevent Urinary Incontinence Syndrome in the Bitch

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Abstract: To asses a technique for the prevention of urinary incontinence syndrome (UIS) in female dogs to be castrated, with predispositional characteristics such as obesity, age or breed. After ovariohysterectomy (OVH), in a second intervention colposuspension is perfomed using two aponeurotic slings obtained from the abdominorectal muscles of the fasciae. Descriptive study, 16 female dogs predisposed to developing the UIS after neutering. After the traditional OVH, the colposuspension was perfomed in all bitches using two aponeurotic slings obtained from the abdominorectal muscles of the fasciae, passed through the abdominorectal muscles and peritoneum and attached to the remaining vaginal/uterine stump. All animals were submitted to radiological exams (cystoretrography) and clinical observation over a mean period of 36 months. All bitches became continent after the surgery and remained continent over a period of 36 months (mean time of 26 months). The bladder and the urethro-vesical sphincter maintained themselves cranially to the pubic bone during the time of observation. An animal not included in this study was euthanized one month after surgery and no adhesions between the slings and other abdominal organs were detected. No fistulas were found in any of the operated animals. This proposed preventive technique can prevent the occurrence of urinary incontinence syndrome in female dogs to be neutered, with predispositional characteristics. The clinical/radiological control of the large number of bitches over a longer period of time should be perfomed in order to confirm the direct relevance of this procedure in terms of veterinary surgical clinical application.

Key words: Ovariohysterectomy, colposuspension, urinary incontinence and bitch

Introduction

OVHs are perfomed in bitches basically to control sexual function in order to solve obstetrical problems. There might be UIS development as a consequence of this procedure; but the association of UIS with previous surgery is frequently missed because of the late occurrence of the syndrome. The mean interval for this syndrome to appears is 2 and 9 years, with 75% of cases occurring during the first years 3 after surgery (Arnold *et al.*, 1989 and Arnold, 1999a). Whether castration was perfomed before or after the first estrus (Arnold, 1992; Hart and Cooper, 1984) or whether the technique used was the ovariectomy or ovariohysterectomy (Okkens *et al.*, 1997) seems to have no particular effect. Obesity is a risk factor of higher and significant incidence in bitches weighed more than 20 Kg. Therefore, the medium and large breeds are the ones more affected, in the following decreasing order of risk: Boxer (Arnold *et al.*, 1989), German Sheepdog (Ruckstül, 1978), Doberman Pinscher (Adams and DiBartola, 1983), Old English Sheepdog (Holt, 1989), Springer Spaniel (Holt, 1985a), Bouvier des Flanders (Okkens *et al.*, 1997) and Dachshund (Arnold, 1999b). Obesity acts by cranially moving the caudal peritoneum through the retroperitoneal fat, setting the bladder neck in the pelvic region (Holt, 1985b and Holt, 1987). This fact may partly explain the correlation between castration and UIS (Edney and Smith, 1986).

UIS is mainly detected in middle-aged neutered fat bitches of medium and large breeds. Urine overflow normally occurs when the affected animal is lying in decubitus, resting or sleeping (Arnold *et al.*, 1989; Ruckstül, 1978; Gregory *et al.*, 1992 and Krawiec, 1989). Many bitches with UIS have urine reflux, which is accumulated in the vaginal vestibule causing cystitis. Some authors have suggested a relation between docked breeds (Boxer, Rottweiler, Doberman, Old English Sheepdog) and UIS, due to atrophy or damage of the levator ani and coccygeus muscles, since both muscles are inserted in the caudal base and are responsible for the maintenance of the pelvic lumen (Gregory, 1994; Holt and Thrusfield, 1993; Janssens and Peeters, 1997).

In a study on 83 incontinent bitches, 50% of them showed daily urine overflow, i.e. a severe kind of UIS and the rest of them just showed sporadic overflow (Arnold, 1999a and 1999b). Even though the UIS mechanism is multifactorial, it mainly affects bitches with short urethra, diminished urethral tonus and a bladder (urethrovesical junction) in a markedly posterior position in relation to the abdominal cavity in the prepubic region (Gregory, 1994; Janssens and Peeters, 1997). Some bitches with this syndrome respond to treatment with exogenous estrogens, with increased urethral tonus and improved smooth musculature contraction because of the sensibility α-adrenergic

nerves (Holt, 1989). These cases are considered to be hormone dependent. In the absence of urinary tract infection or anatomic abnormalities and in the presence of a response to hormonal treatment, these bitches should not be diagnosed as having UIS, but rather as having urethral or stress incontinence. However, there seem to be no significant differences in endogenous estrogen concentrations between healthy continent bitches in anestrus and neutered bitches. When attempts were made to maintain normal estrogen levels in neutered bitches by implanting tissue from the recently removed ovary under the stomach serosa or intestines, the expected results were not obtained but rather the implanted tissue was predisposed to the development of malignancy (Arnold *et al.*, 1988 and Davies, 1989).

There has been an increase rate of UIS diagnosis with the use of ordinary radiological exams in veterinary clinics because these exams highlight the bladder neck caudally settled against the pubic bone (Adams and DiBartola, 1983; Holt, 1985a and 1985b). In 75% of the adult neutered bitches with UIS, the peak of clinical symptoms appears before they complete 3 years of OVH (Arnold, 1989 and Holt, 1985b) and might occur 5 weeks after the surgical procedure (Ewers and Holt, 1992) . The rate of occurrence of this syndrome is more frequent among neutered bitches than intact animals (Holt, 1985a; Krawiec, 1989; Holt and Thrusfield, 1993 and Thrusfield, 1985) and many hypotheses have been raised to explain this phenomenon. The formation of adherence between the bladder neck and the vaginal/uterine stump post-OVH is the most acceptable cause (Banks *et al.*, 1991; Holt, 1990 and Pearson, 1973). According to some authors, the estrogen deficiency after castration could determine the appearance of UIS (Thrusfield, 1985 and Finco *et al.*, 1974). However, we should take into consideration that: only 20% of neutered bitches develop UIS (Arnold, 1999a and 1999b), that estrogen treatment is not effective in 25% of the affected bitches (Arnold *et al.*, 1989) and that the serum concentration of estradiol in neutered bitches with UIS is the same as in intact bitches in anestrus (Richter and Ling, 1985). Thus, estrogen probably is etiologically involved, but it not the only factor responsible for this event.

Urethral sphincter mechanism incompetence (SMI) is the most common cause of UIS in the adult bitch (Gregory, 1994). The physiopathology of UIS after castration is not well understood. It is generally accepted that the cause is SMI (Rosin and Barsanti, 1981). Urodynamic exams and evaluation of the bladder and urethra pressure can demonstrate that the urethral sphincter closure function in bitches with UIS is significantly reduced when compared to continent animals (Arnold, 1999a and 1999b; Richter and Ling, 1985). The function of routine surgical techniques used to increase the sphincter resistance to urinary flow such as colposuspension (Holt, 1990; Gregory and Holt, 1993), cystourethropexy (Massat *et al.*, 1993), transpelvic sling with and without colposuspension (Okkens *et al.*, 1997), peri-urethral Teflon (polytetrafluoroethylene) application (Arnold *et al.*, 1989), collagen injection into the urethral submucous membrane (Arnold *et al.*, 1996) and uroplasty (Holt and Thrusfield, 1993; Bushby and Hankes, 1980; Laing, 1999 and Waldron, 1998) is to correct a pre-existing UIS.

The objective of the present study was to use a surgical technique to prevent the occurrence of UIS in bitches with predisposing characteristics and to be submitted to OVH for neutering or for the correction of obstetrical problems.

Materials and Methods

The study was approved by the Ethics Committee of our institution. The animals used in this study were 16 bitches scheduled for OVH seen at the surgical unit of the Veterinary Science Center (VSC). All of them were over 3 years old and had variable degrees of obesity (mean ± SD weight: 21 ± 6.7 kg,), with the presence or absence of obstetrical pathologies. The animals were selected so that we could follow them for a long period of time, if necessary, for radiological exams and to check bladder position and micturition behavior (Table 1).

After a 12-hour fast and 6-hours water deprivation, the pre-anesthesia consisting of atropine sulfate (0.04 mg/kg e.v.) and acepromazine (0.1 mg kg^{-1} e.v.) was administered to each animal, followed 15 minutes later by anesthesia induced with ketamine (5 mg kg^{-1} e.v.) and xylazine (1.1 mg kg^{-1} e.v.) and maintained with general inhalant anesthesia (halothane). After disinfection of the surgical area, the animals were submitted to infra-umbilical mid-line laparotomy and OVH by standard procedures. Two slings about 1cm wide and varying in length according to the animal's size were removed from the aponeurotic abdominorectal muscles. Each sling was obtained on one side parallel to the white line, starting from the middle hypogastric area and ending near the umbilical scar (Fig. 1 and 2). The aponeuroses from where the aponeurotic slings were removed was closed with simple continuous suture (Vycril® n. 1). Both aponeurotic slings were introduced into the abdominal cavity using a Halstead hemostatic forceps through the abdominorectal muscle and peritoneum (Fig.3) and attached to the post-ovariohysterectomized vaginal/uterine stump with isolated simple Vycril® n.1 stitches (Fig. 4). Laparorrhapy was perfomed by standard procedures. Gentamicin has been administrated (3 mg kg^{-1} i.m.) was administered for 5 days after surgery and a dressing was applied twice a day to the site of incision.

The position of the bladder in the abdominal cavity was

Table 1: Bitches* assisted at the hospital of VSC with obstetrical problems or neutering used in this study

Bitches	Breed	Age (≈ years)	Weight (kg)	Clinical Diagnosis	Surgical Procedures
1	Boxer	5	18	Pyometra	OVH/Colp[3]
2	German Shepherd	7,5	21	Distocia	Ces/OVH/Colp[4]
3	German Shepherd	6,5	20	Distocia	Ces/OVH/Colp
4	MBB[1]	8	15	Neutered	OVH/Colp
5	Boxer	6	18	Pyometra	OVH/Colp
6	Rotweiler	5	27	Distocia/TM[2]	Ces/OVH/Colp
7	Brazilian Fila	8	31	Distocia	Ces/OVH/Colp
8	MBB	10	16	Pyometra	OVH/Colp
9	MBB	7	21	Distocia	Ces/OVH/Colp
10	Rotweiler	5	28	Distocia	Ces/OVH/Colp
11	Rotweiler	4	25	Vaginal Hiperplasia	OVH/Colp
12	MBB	7,5	16	Neutered	OVH/Colp
13	Boxer	7	21	Pyometra	OVH/Colp
14	German Shepherd	5	23	Distocia	Ces/OVH/Colp
15	MBB	9	18	Pyometra	OVH/Colp
16	MBB	6	18	Distocia	Ces/OVH/Colp

None of these presented UIS at the moment of surgery; [1] MBB, mixed breed bitch; [2] MT, mammary tumor; [3] OVH/Colp - ovariohysterectomy followed by Colposuspension; [4]Ces/OVH/Colp - cesarean (live or dead fetus) followed by ovariohysterectomy and colposuspension

determined by radiographic exams (cystoretrography) using retrograde positive contrast with sodium diatrizoate (Hypaque® 50%) two months after the surgical procedure and then every six months. The owners brought the animals to the clinic and reported the necessary information.

Bitches were selected among those that had the possibility of developing UIS after neutering according to breed, size, age or degree of obesity. No statistic comparative test was done between the bitches from this experiment with the entire bitches or neutered bitches with previously UIS.

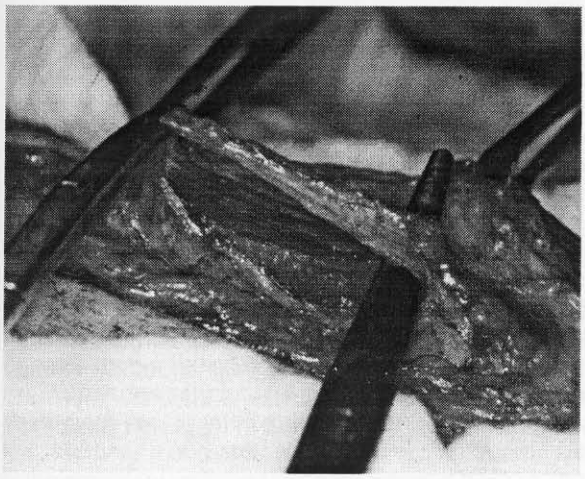


Fig. 1: One of the aponeurotic sling which will be attached after post-ovariohysterectomized vaginal/stump as resulting of unilateral preparation of the fasciae of tunic flava and abdominorectal muscle

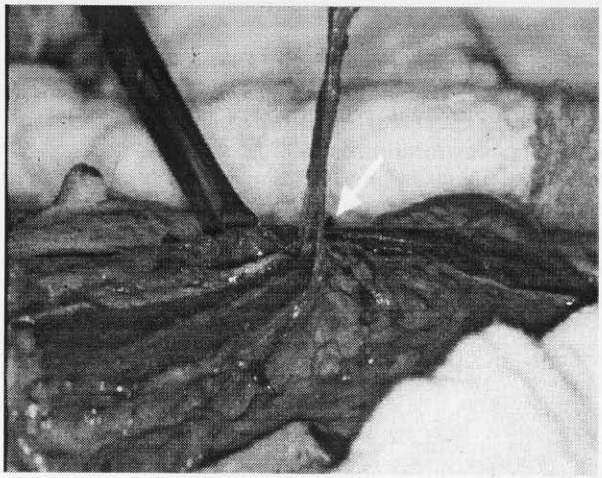


Fig. 2: Aponeurotic sling prepared from abdominorectal muscle of the fasciae from one side parallel to the white line. The caudal portion of aponeurotic sling remains continuous with the aponeurotic of abdominorectal muscle (arrow) and ready to be introduced to the abdominal cavity

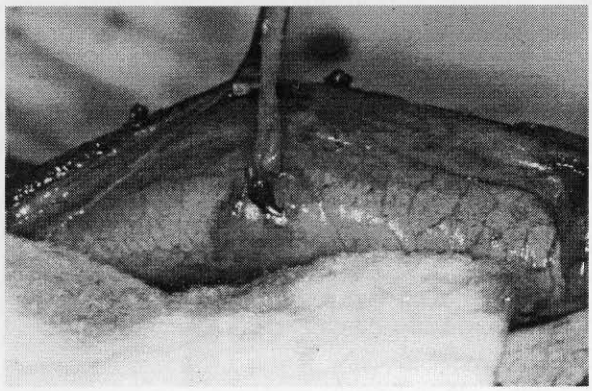


Fig. 3: Introducing of one aponeurotic sling through the abdominorectal muscle and peritoneum with the help of a Halstead hemostatic forceps

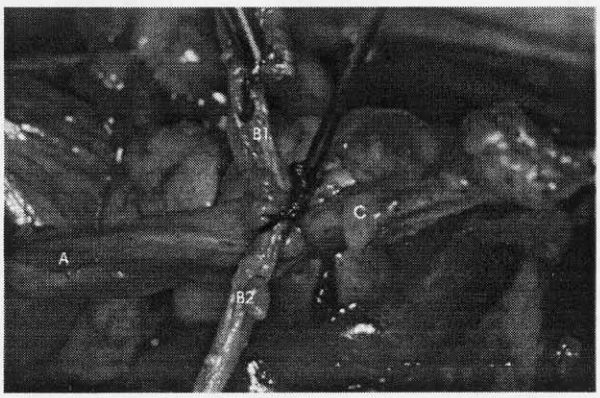
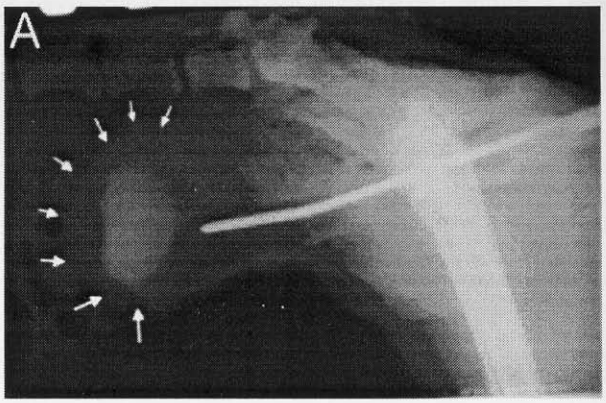


Fig. 4: The two aponeurotic slings (B1 and B2) attached to the post-ovariohysterectomized vaginal/uterine stump (A). Cranial portion of the vaginal/uterine stump that will be resected (C)

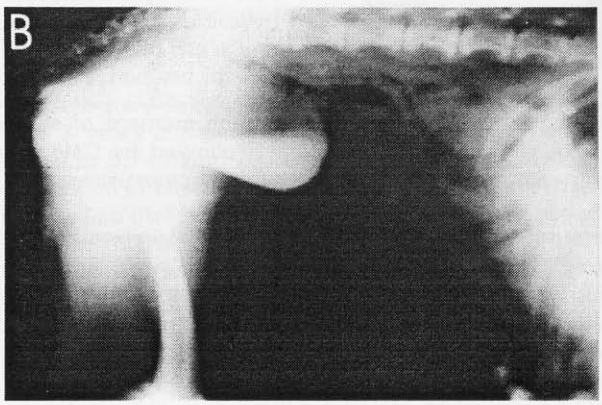
Results

The release of both aponeurotic slings from the border of the fasciae of the abdominorectal muscle was quick and easy, never increasing the surgical time and their passage through the abdominorectal muscle and peritoneum was satisfactory with no occurrence of hemorrhage. The attachment of the aponeurotic slings to the vaginal/uterine stump managed to keep the bladder in its normal anatomical position.

The bladder neck position in continent bitches is normally intra-abdominal (Fig. 5A) and in the bitches with UIS the bladder is partially or totally intrapelvic (Fig. 5B). In this study, the bladder and the urethrovesical sphincter remained attached to the pubic bone in the abdominal cavity, as verified radiographically for a mean 36-month period of time for all animals (Fig. 6). One animal, not



(A)



(B)

Fig. 5: Retrograde positive contrast vagino-urethrogram in a mixed breed bitch, entire and continent with bladder at the same normal anatomic position (arrows) (A); the same contrast in a old Collie bitch (13 years), neutered and with UIS showing the bladder partially intra-pelvic (B). Both animals in lateral abdominal radiograph

included in this study, was euthanatized one month after the surgery. Examination of this animal showed total cicatrization between the vaginal/uterine stump and the aponeurotic slings with no adherence between the organs and the bladder was in its proper position.

Discussion

Acquired UIS affects 20% of all neutered bitches, with a strong relationship between weight, age and breed in the incidence of this syndrome. The mean interval for the occurrence of UIS is within 2-9 years, mostly during the first 3 years after surgery (Arnold *et al.*, 1989). Surveys have reported strong evidence of the effect of OVH on UIS development (Holt, 1985a;

Thrusfield, 1985; Krawiec, 1989 and Holt and Thrusfield, 1993). This fact might be related to the adherence between the bladder neck and the vaginal/uterine stump (Holt, 1990). In veterinary medicine the proposed methods for these cases are basically corrective, when the animals have already shown clinical symptoms (Holt and Thrusfield, 1993; Laing, 1999). Due to the high incidence of this alteration in middle-aged women (47 ± 2 years old) submitted to hysterectomy, surgeons consider the application of preventive techniques such as BURCH (Burch, 1961; Hilton and Stanton, 1983; Stanton and Cardozo, 1979) colposuspension by fixation of the Cooper ligament.

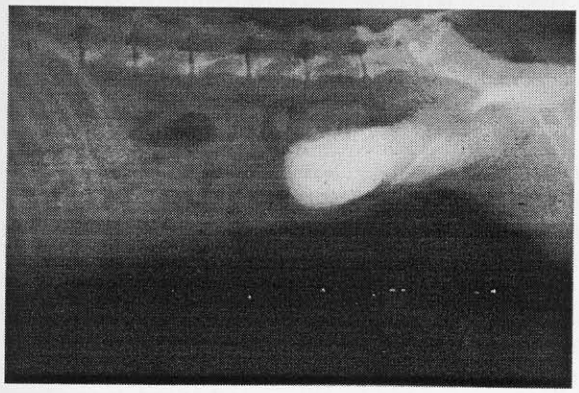


Fig. 6: Radiographic control in one of the bitch of this experiment (Animal 4) after 36 months of OVH and colposuspension. Note the correct position of the bladder in the abdominal cavity

Because of the 'pelvic floor' characteristics of canines and the difficulty in executing a posterior cystopexy due to the lack of anatomical structures in this region, many techniques have been developed such as the creation of special autogenous facial slings in such a way to keep the urethra and the bladder neck in their original abdominal position (cystourethroplasty) (Bushby and Hankes, 1980; Hobson and Bushy, 1985; Massat *et al.*, 1993; Waldron, 1998 and Laing, 1999) Another method used is colposuspension, in which the vaginal/uterine stump is bilaterally sutured to the abdominal wall involving the bladder neck. In most of the bitches this neck stump is not enough, with complementary vaginopexy being required (Holt, 1990). The vaginal/uterine remaining portion heals and retracts quickly after OVH, drawing the urethrovaginal junction to an intrapelvic position. In most cases, later repairs are not possible. Urethroplasty combination after colposuspension seems to bring a few benefits to incontinent bitches (Muir *et al.*, 1994). Teflon injections into the urethral submucosa in bitches with UIS determine several reactions such as foreign antigen, mainly rejections of this material by tissue (Arnold *et al.*, 1989). Except for its high cost, collagen has proved to be superior to Teflon in terms of biocompatibility, with no adverse reactions occurring after its application (Arnold, 1999a).

The return visits to the clinic of the VSC for neutered bitches with predispositional characteristics (middle age, obesity, medium and large breeds) revealed that 20% showed UIS about a year or more after surgery. The preventive method proposed in this study created autogenous aponeurotic slings from the abdominorectal muscle edges that are fixed to the vaginal/uterine stump right after the OVH, restraining its retraction, involving the bladder neck and keeping the urethra in its position, thus preventing the appearance of UIS. Routine radiographic exams showed that the bladder neck was caudally settled against the pubic bone in bitches with UIS (Adams and DiBartola, 1983; Holt, 1985b). Most authors consider that the bladder neck is in an have intra-abdominal position in healthy continent bitches, whereas is it in an intrapelvic position in bitches with UIS (Holt, 1985a; Gregory, 1994; Holt, 1990; Hoppe, 1994 and Gregory *et al.*, 1999). This position of the pelvic lumen modifies the pressure between the bladder and the urethra, with this fact being more evident in neutered bitches (Adams and DiBartola, 1983; Holt, 1985a and Okkens *et al.*, 1997), mostly when they lie in decubitus (Gregory and Holt,1992). In all the animals studied here, the bladder neck remained in an intra-abdominal position, in front of the pubic bone and without change micturition during the 36 months of evaluation through by clinical examinations and radiological controls.

Another exam used in IU diagnosis is urethral pressure measurement. A catheter with a transducer is introduced into the bladder and pulled slowly throughout the length of the urethra under constant perfusion and the electronic signals are sent to a computer (Gregory *et al.*, 1992; Gregory and Holt, 1993). The diagnosis is obtained by analysis of the negative or positive peaks of the maximum pressure parameters of urethral closure and the functional length of the urethra according to the criteria of the *International Continence Society* (Abrams *et al.*, 1988). This exam must be done under general anesthesia (Holt, 1990; Gregory *et al.*, 1992 and Gregory *et al.*, 1999), which interferes with the results and represents an additional risk since normally aged animals are treated. Vocalization or irregular respiration also changes the negative peaks. With all of these variables, the radiographic position of the bladder neck in relation to the pubis is a better evaluation parameter than urethral pressure (Gregory *et al.*, 1992 and Gregory, 1994). In the present study urodynamic exams were not perfomed because the equipment is not routinely

used in veterinary clinics due to its high initial and maintenance costs, but is only used for specific purposes. Several authors (Gregory *et al.*, 1992; Gregory, 1994 and Gregory *et al.*, 1996) have suggested a combination of urethral pressure data and the radiographic position of the bladder for an effective diagnosis of UIS.

Conclusion

The preventive technique proposed here can prevent the short- or long-term development of urinary incontinence syndrome, without requiring any changes in the regular surgical procedure for ovariohysterectomy in bitches. Long-term clinical/radiographic control of the studied bitches is necessary to establish a direct relevance of this procedure to surgical veterinary practice.

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