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RESEARCH ARTICLE OPEN ACCESS

BIOCHEMICAL AND HISTOLOGICAL EVALUATION OF THE INFLAMMATORY RESPONSE TO BARBED POLYDIOXANONE AND POLYGLACTING 910 IN VAGINAL APEX AND ABDOMINAL APONEUROSIS SUTURE IN PIGS SUBMITTED TO HYSTERECTOMY

Gilmar Alves do Nascimento[1], Adriana YurikoKoga[2], Alceu de Oliveira Toledo Junior[3], Bruna Carletto[4], Leandro Cavalcante Lipinski[5], Mário Rodrigues Montemor Netto[6], Laryssa De Col Dalazoana Baier[7,*] and Ricardo Zanetti Gomes[8]

[1]Master's Degree, Medicine Department, State University of Ponta Grossa, Brazil. Conception and design, data acquisition, technical procedures, manuscript writing, critical review
[2]Master's Degree, Pharmaceutical Sciences Post-Graduation Program, State University of Ponta Grossa, Brazil. Technical procedures, preparationofmanuscripts
[3]Master's Degree, Clinical Analysis Department, State University of Ponta Grossa, Brazil. Data analysisandinterpretation, biochemicalparameters
[4]Master's Degree, Pharmaceutical Sciences Post-Graduation Program, State University of Ponta Grossa, Brazil. Technical Procedures, preparation of manuscripts
[5]PhD, Medicine Department, State University of Ponta Grossa, Brazil. Conception and Design, data analysis and interpretation, technical procedures, statistical analysis, critical review
[6]Master's Degree, Medicine Department, State University of Ponta Grossa, Brazil, Data analysis and interpretation, histopathological exams
[7]Mester's Degree, NusinDepartament, State University of Ponta Grossa, Brazil. Techinical procedures, preparation od manuscripts
[8]PhD, Medicine Department, State University of Ponta Grossa, Conception and Design, relevant scientific and intellectual contributions to the study, critical review and final approval

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****Corresponding author:***
Laryssa De Col DalazoanaBaier

ABSTRACT

The number of women submitted to hysterectomy grows every year. Such procedure can be carried out using different techniques regarding access, type of suture and the surgical thread used. Surgical threads play a relevant role in surgical practice and there is a great variety of materials with which they are produced. Therefore, they enable the use of different suture techniques, minimizing the tissue reaction and reducing the time needed for this procedure. This study aimed to demonstrate that both threads have similar characteristics and, therefore, we can suggest the use of Stratafix® for procedures that minimize surgical time is relevant (laparoscopic video surgeries, for example). This study carried out 16 abdominal hysterectomies in pigs, divided into two groups, eight using polydioxanone thread (Stratafix®) and the other eight using polyglactin 910 thread (Vicryl®). Blood samples were collected before the surgery, (D1) and in the collection of aponeurosis and vaginal Apex samples (D9). The blood samples, (D1 and D9) were submitted to the following examinations: Complete blood count andfibrinogen and C reactive protein measurement, to evaluate systemic inflammatory reaction. When the aponeurosis and vaginal apex samples (D9) were collected, the presence or absence of local adherences or abscesses was observed, and then the material was sent to histological analysis, for the evaluation of fibrosis and fat encapsulation, Classification and attribution of indices to the histological findings and later characterization of the inflammatory process phase. In this study, we did not observe significant changes in the data analyzed in relation to both types of thread investigated.

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INTRODUCTION

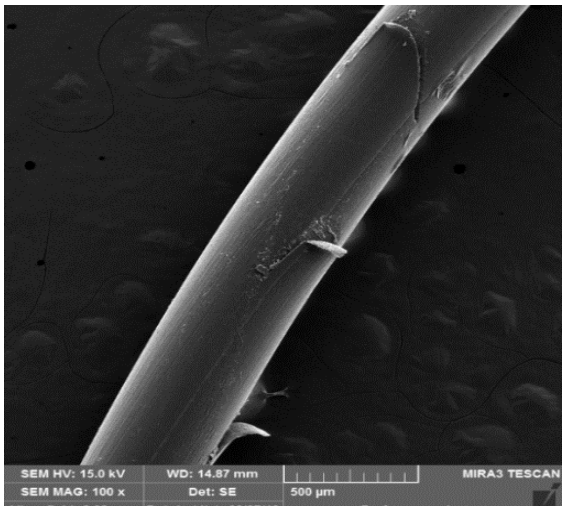
Every time a surgical procedure is carried out, a surgical wound is created, and at the end of such procedure, the access used must be closed. This is called surgical wound suture. Such wound suture is the final step in most of the surgical procedures, and it aims at restoring the integrity of the tissues that were cut, as well as resisting to extrinsic tensile strength until the scar reaches its own tensile strength (Tormena, 2017). In general, in the last few decades several changes have been seen in relation to hysterectomy procedures, both regarding preferred access and indications and counter-indications regarding different accesses, and a growing trend has been observed towards the use of vaginal and laparoscopic accesses, while the latter is considered an advanced surgery, being chosen in extra-uterine pathologiessuch as adherences and adnexal diseases (Cosson, 2001; Chapron, 2002). The laparoscopic surgery is an important advance in the current surgery, based on the principle of minimally invasive surgery, whose advantages are: decrease in the post-surgical discomfort and early hospital discharge, with reduction in complications (hernias, surgical site infection, among others).This technique presents better results, improving women's quality of life and reducing mortality rates in hysterectomies (Makinen, 2001). In every hysterectomy (surgical procedure), either in the open surgery or in the video laparoscopic procedure, the technique used for the vaginal apex suture is extremely important as well as the material to be used in this surgical time, since we should minimize as much as possible the several complications that might appear, such as dehiscence, inflammation, infection and adherences.

Therefore, it is necessary to develop more scientific studies aiming at reducing the existing doubts about the theme, prioritizing their physical characteristics, main indications, counter indications, in order to support the surgeon when making decisions about the most convenient material to be used. Special attention must be given to this phase when dealing with ischemic and contaminated tissues. Sutures aim at joining and stabilizing wound edges for a time that is needed for the recovery of the natural tensile strength (Kumar *et al*., 2013). The suture thread is known to help tissue recovery, but its contact with the wound might result in tissue reaction, ischemia, dehiscence, absorption and dissemination of secretion and microorganisms, triggering greater traumatism, inducing the formation of adherences, delaying and changing the healing process (Greenberg, 2009).

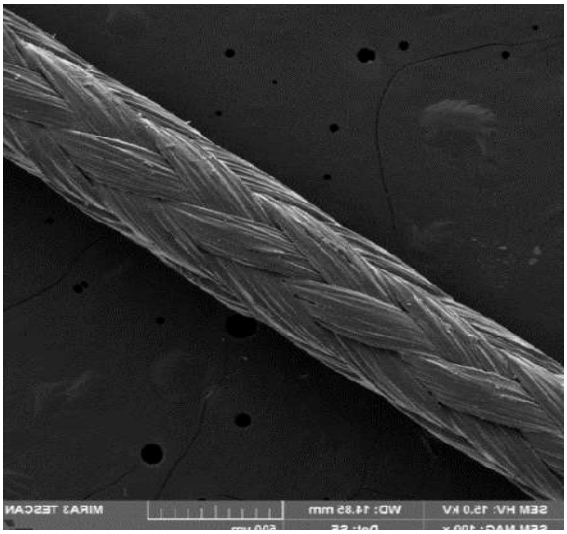
For this reason, in addition to these possibilities, the wrong choice of suture material might seriously hamper the healing process and, therefore, the success of the whole surgical procedure [5]. Sudden events such as cough, vomit, physical exercises and extreme activities (traumas) generate greater stress in a short period of time, predisposing the patient to the rupture of the biomaterial. Rupture, in turn, is defined by the discontinuity of the thread, since it does not occur in the traction site. The knot region is the weakest point in the suture, due to the reduction in the thread diameter and concentration of the tensile strength on a single stitch (Muffly, 2010). The objective of this study is to compare the inflammatory, laboratory and histological response, scar stability, and the presence or absence of adherences or suture dehiscence between the two threads used to carry out the suture of vaginal apex and abdominal aponeurosis in pigs: polydioanone thread (knot free continuous suture), and polyglactin 910 thread (suture with separated stitches and knots).

MATERIAL AND METHODS

The process CEUA – 02/2018, under protocol UEPG – 10965/2017 was analyzed by the Animal Use Ethics Committee and was approved on 22/06/18. The study was carried out in the surgical technique laboratory at the State University of Ponta Grossa, and 16 prepubertal female pigs were used weighing between 15 and 25 kg. They were kept in individual stallspre and post-surgery for 09 days when they were re-operated and later on euthanized. Studies have reported that the tissue reaction to the sutures starts with the trauma caused by the passage of the needle and thread, however the reaction to the thread itself, starts between the second and seventh day after its implantation, and was based on these data , that clinical and histopathological evaluations were performed on the ninth postoperative day (Hering, 1993) They were duly fed with pig food, received suitable water supply and were kept in a clean, aired and suitable environment to guarantee their well-being. The animals were divided into two groups G1 (polyglactin 910-Vicryl®) and G2 (polydioxanone-Stratafix®). For the statistical analysis, the animals in Group G1 were sub-divided into G1c for vaginal Apex and G1a for aponeurosis and the group G2 was sub-divided into G2c for vaginal apex and G2a for aponeurosis.



a- Polydioxanone thread (Statafix®)



Source: the author (2019)

b Polyglactin 910 thread (Vicryl®)

Fig. 1.

Images obtained at the UEPG electronic microscopy laboratory

Anesthetic Protocol: The animals were kept fasting for 12 hours in the pre-surgical period. They received pre-anesthetic medication based on intramuscular Acepromazine (0,4 mg/kg), Ketamine(14mg/kg) and Xylazine (0,2mg/kg). After vascular access in the auricular vein, Propofol (5mg/kg) IV was used for anesthetic induction. After induction, tracheal intubation was carried out, and the maintenance used isoflurane in a 1,2 to 1,7% minimum alveolar concentration. The animals were monitored throughout the surgery through capnography.

Surgical Technique

Surgery Description (Hysterectomy): After anesthesia, antisepsis was carried out with a solution containing 70% alcohol, associated to 10% povidone-iodine, with 50% of each element. Next, sterilized cotton fields were placed exposing the surgical area. After that, the skin was opened (with a median incision), and the abdominal wall per planes (subcutaneous, aponeurosis, muscular and parietal peritoneum, simultaneously with the hemostasis with simple 3-0categut. Then, cavity inspection was carried out and the structures were identified. Next, the ligaments and bilateral ovarian vessels were clamped, sectioning and linking the vessels with 3-0 categut, keeping the ovaries intact (oophorectomy was not carried out). After that time, the parametria were clamped, vessels were sectioned and linked with 3-0 categut. In the next step, the vaginal apex was sectioned and the womb was removed. After this surgical time, the vaginal apex suture was carried out, (one group withpolidioxanone 2-0 and the other group with polyglactin 2-0). In the group using polydioxanone, 2-0, the continuous suture was performed, only invaginating the edges of the suture, both at the beginning and at the end of it. When polyglactin 910 was used, the suture was continuous, however, stitches were given at the beginning and at the end of the suture. Later on, hemostasis was carried out with 3-0categut. Before starting the closure of the abdominal wall, a rigorous inspection of the cavity was carried out to observe whether there was bleeding. Once the absence of bleeding was confirmed, the abdominal muscle approximation was performed with 3-0categut followed by aponeurosis suture. One group used polydioxanone 2-0 (continuous suture without stitches), while the other groups used polyglactin 2-0 (continuous suture with stitches at the beginning and at the end of the suture). After the subcutaneous tissue had been approximated with 3-0 categut 3-0, the surgery was concluded with the skin closure using subcutaneous suture withmononylon 3-0.A bandage was placed on the surgical site.

Surgery description (removal do the vaginal apex and aponeurosis): On the ninth day after hysterectomy, the previous anesthetic protocol was repeated, differing from the type of surgery performed in that the skin and subcutaneous tissue were opened and the sutured aponeurosis was removed along with the whole extension of the suture thread used and placed in 10% formalin. Next, the vaginal apex was removed along with the suture thread, also placed in 10% formalin. After that, the animals were euthanized with 19% potassium chloride.

Blood Collection: The blood collections were carried out through the puncture of the external jugular vein with a vacuum collection needle (21 G, 25x0, 80mm) in a tube containing gel and a 5ml blood clotting activator to extract the serum and in a tube with 3,2% 3 ml sodium citrate, for plasma extraction. Fribrinogen and Reactive C protein were measured, and full blood count values were analyzed.

The biochemicalanalysesemployed:

- Equipment: XE2100L
- Principle:
  - Electrical impedance (direct current): RBC, PLT, HCT (measured) and immature cell differential;
  - Fluorescent flow cytometry: WBC, counting of reticulocyte, erythroblasts, immature platelets and platelet optical count;
  - Radiofrequency:immaturecelldifferential
- yotometria: HGB. Cyanide-free reaction

Collections were carried out according to Chart 1:

Chart 1. Collections

D1	**Pre-surgery**
D9	9 days after surgery

Source: The Author (2018)

Microscopy

The vaginal apex and the aponeurosis fragments were preserved in a 10% formalin solution and sent to the Pathology Laboratory. The slide preparation was preceded by tissue dehydration with ethyl alcohol, treatment with xylol, impregnation and inclusion in paraffin blocks. The microtomy was carried out with 3 µm thick cuts.After cut, the fragments were stretched in water bath and stuck to glass slides.
Staining was performed using the hematoxylin-eosin methods. The pathologist was blinded for the group.

Hematoxylin-eosin staining: Fragments were removed from the aponeurosis and the vaginal apex and fixed in 10% (v/v) formalin solution. After fixation, the material was dehydrated ethyl alcohol, treatment with xylol, impregnation and inclusion in paraffin blocks, sectioned in microtome with 3 µm thickness and stained with Hematoxylin and Eosin (HE) for the evaluation of the inflammatory response regarding cellularity and angiogenesis, under light microscopy. After analysis and selection, the histological sections were photographed using an Olympus BX 41 1998 microscope assisted by the programCellSens Standard. Qualitative and quantitative analyses of the samples were carried out. The histological analysis included foreign body granuloma, inflammatory response and fibrosis. The evaluation scale for fibrosis and fat encapsulation is shown in chart 2:

Chart 2. Fibrosis and fat encapsulation

Degree	Description
0	No capsule, no reaction
1	Capsule or inflammatory process smaller than 0.5mm
2	Capsule or inflammatory process from 0.6 to 1.0mm
3	Capsule or inflammatory process from 1.1 to 2.0mm
4	Capsule or inflammatory process larger than 2.0mm

Source: Adapted from Gonzalez and Ramshaw[9]

For the quantitative analysis of the inflammatory parameters we used the table adapted fromVizzoto Jr. *et al*. (2003), according to Charts 3 and 4:

Chart 3. Classification and attribution of indices to the hematoxylin-eosin histological findings

Inflammatory parameters	Intensity			
	High	Moderate	Discrete	Absent
Neutrophils	-3	-2	-1	0
Edema	-3	-2	-1	0
Congestion	-3	-2	-1	0
Monomorphic nuclear	3	2	1	0
Granulation tissue	3	2	1	0
Fibrosis	3	2	1	0

Source: Adapted from Vizzotto Jr. *et al*.[09]

Chart 4. Characterization of the inflammatory processphase according to the final score of each animal

Sum of the indices found in each subgroup	Classification final score
Acute	-9 to -3
Subacute	-2.9 to 3
Chronic	3.1 to 9

Source: Adapted from Vizzotto Jr. *et al*.[10]

Macroscopy: Macroscopically, the presence of adherences, formation of fistulas or abscesses, wound dehiscence, secretion and cosmetic appearance are evaluated. This analysis can be carried out using visual, ultrasound, laparoscopic and thermographic inspections,differently from what we have in the microscopic assessment of tissue response in terms of cellularity (macrophages, monocytes, lymphocytes, fibroblasts), blood vessels and connective tissue (collagen type I and type III) (Ballantyne, 1983).

Statistical analysis: For the statistical analysis, the animals in group G1 (Vicryl®) were subdivided into G1c for the vaginal apex and G1a for the aponeurosis and group G2 (Statafix®) was subdivided into G2c for vaginal apex and G2a for aponeurosis. Initially, the data descriptive analysis was carried out with estimates of mean, median, standard deviation and minimum and maximum of all variables, both individually and per group. Next, a non-parametric approach to the data was adopted due to n = 8 in each group and the existence of variables with constant values. The difference between groups was investigated by using the Mann-Whitney U test. For better visualization of results, graphs of the type boxplot were produced, with differentiation between groups and times evaluated. The test results were considered significant when p<0,05 and the analyses were carried out in an SPSS 21.0

RESULTS

Hematologic analysis

Fibrinogen

PCR

Leucogram: Complete blood cell counts and biochemical examinations were carried ou (Fibrinogen, PCR) pre and post-surgery in the sixteen animals, subdivided into two groups: G1 group subdivided into G1c for vaginal apex and G1a for aponeurosis and G2 Group into G2c for vaginal apex and G2a for aponeurosis.

Fibrinogen

Fibrinogen evaluation

Leucogram: Among the results obtained, the seric pre-surgery fibrinogen mean value observed was 135.38 mg/dL ± 41,11 for the animals in the group Statafix® and 174.4 mg/dL ± 67.67 for the animals in the groupVicryl®.

Table 1. Hemogram D1

Day 1	Stratafix®	Vicryl®	p-value
	M±SD	M±SD	
Fibrinogen (mg/dL)	135.38 ± 41.11	174.4 ± 67.67	0.161
PCR (mg/dL)	0.01 ± 0	0.01 ± 0	1.000
Red blood cells (million/µL)	6.43 ± 0.95	6.78 ± 0.47	0.442
Hemoglobin (g/dL)	11.55 ± 1.63	11.61 ± 0.6	0.798
Hematocrit (%)	36.61 ± 4.99	37.54 ± 1.67	0.382
MCV (fL)	57.35 ± 5.81	55.58 ± 3.76	0.505
HCM (pg)	18.04 ± 1.28	17.19 ± 0.92	0.279
MCHC (%)	31.54 ± 1.24	30.95 ± 0.9	0.279
RDW (%)	20.73 ± 3.91	17.8 ± 1.11	0.083
Total Leukocytes (µL)	13463.25 ± 2175.96	16845.38 ± 2815.69	0.021
Eosinophils (%)	0.13 ± 0.35	0 ± 0	0.721
Basophils (%)	0.25 ± 0.71	0.5 ± 0.93	0.721
Lymphocytes (%)	58.13 ± 15.43	57.13 ± 15.08	0.878
Atypical Lymphocytes (%)	0.25 ± 0.71	0 ± 0	0.721
Monocytes (%)	4.13 ± 1.73	5.5 ± 2.56	0.382
Myelocytes (%)	0 ± 0	0 ± 0	1.000
Metamyelocytes (%)	0 ± 0	0 ± 0	1.000
Rods (%)	0.63 ± 1.19	0.5 ± 0.76	0.878
Segmented (%)	36.88 ± 16.8	36.63 ± 12.96	0.959
Neutrophils (%)	37.5 ± 16.22	37.13 ± 13.44	0.959
Platelets (µL)	318625 ± 86967.87	363750 ± 86412.22	0.442
MPV (fL)	9.23 ± 0.41	8.65 ± 0,07	0.133

Source: The Author (2018)

Table 2. Hemogram D2

Day 9	Stratafix®	Vicryl®	p-value
	M±SD	M±SD	
Fibrinogen (mg/dL)	155.29 ± 19.15	159.96 ± 20.56	0.463
PCR (mg/dL)	0.01 ± 0	0.01 ± 0	1
Red blood cells (millions/µL)	6.16 ± 1.07	6.11 ± 0,99	0.878
Hemoglobin (g/dL)	10.75 ± 1.96	10.75 ± 1,97	0.878
Hematocrit (%)	33.93 ± 6.51	34.06 ± 5,69	1
MCV (fL)	55.15 ± 4.48	55.91 ± 2,39	0.721
HCM (pg)	17.83 ± 0.87	17.91 ± 0,93	0.798
MCHC (%)	33.7 ± 5.65	31.51 ± 0,65	0.234
RDW (%)	19.48 ± 3.62	18.69 ± 1,68	0.878
Total Leukocytes (µL)	13230 ± 2266.53	15820 ± 2808,29	0.083
Eosinophils (%)	0.25 ± 0.46	1 ± 1,77	0.574
Basophils (%)	0.38 ± 0.74	0.75 ± 0,89	0.442
Lymphocytes (%)	71.25 ± 7.8	59.75 ± 11,85	0.028
Atypical Lymphocytes (%)	0 ± 0	0.25 ± 0,71	0.721
Monocytes (%)	2.75 ± 2.66	4.88 ± 2,03	0.05
Myelocytes (%)	0 ± 0	0 ± 0	1
Metamyelocytes (%)	0 ± 0	0 ± 0	1
Rods (%)	0.25 ± 0.71	0.5 ± 0,53	0.328
Segmented (%)	21.75 ± 10.12	29.88 ± 16,91	0.195
Neutrophils (%)	26.38 ± 7.35	34.13 ± 11,85	0.13
Platelets (µL)	439125 ± 51579.17	350125 ± 121468,91	0.065

Source: The Author (2018)

There was no statistical difference (*P* =0.161). Likewise, there was no difference between the pre-surgical values of seric fibrinogen: the group using Stratafix® presented 155.29 mg/dL ± 19.15, while the group using Vicryl® resulted in 159.96 mg/dL ± 20.56. (*P*=0,463). Fibrinogen is an acute phase protein, and its levels rise when there is inflammation or tissue damage from any cause. These elevations are temporary, and disappear after the cause has ceased. The C reactive protein value was constant pre and post-surgery (0.01 mg/dL) in both groups. Pre-surgery total leukocytes values were 13463.25 cell/uL and 16845.38 cell/uL for theStratafix® andVicryl® groups, respectively. After surgery, the values found for these groups were13230 cell/uL and15820 cell/uL, respectively. Under no circumstance, statistically significant difference was found (*P*=0.442).

Table 3. Difference between D1 and D9

Difference between day 1 and day 9	Stratafix®		Vicryl®		p-value
	Mean	Deviation padrão	Mean	Deviation padrão	
Fibrinogen	17.3	40.3	-14.4	77.2	0.536
PCR	0	0	0	0	1
Red blood cells	-0.3	1.2	-0.7	1.2	0.382
Hemoglobin	-0.8	2.3	-0.9	1.9	0.878
Hematocrit	-2.7	7.8	-3.5	5.1	0.878
MCV	-2.2	4.6	0.3	5.1	0.279
HCM	-0.2	0.9	0.7	1.3	0.05
MCHC	2.2	6	0.6	1.2	0.959
RDW	-1.2	2.8	0.9	1.4	0.05
Total leukocytes	-233.2	2054.6	-1025.4	2785.2	0.442
Eosinophils	0.1	0.4	1	1.8	0.382
Basophils	0.1	1.1	0.3	0.9	0.959
Lymphocytes	13.1	15.4	2.6	16.9	0.505
Atypical lymphocytes	-0.3	0,7	0.3	0.7	0.442
Monocytes	-1.4	4.2	-0.6	3	0.442
Myelocytes	0	0	0	0	1
Metamyelocytes	0	0	0	0	1
Rods	-0.4	0.7	0	0.9	0.505
Segmented	-15.1	15.4	-6.8	20	0.574
Neutrophils	-11.1	18.5	-3	17.5	0.574
Platelets	120500	97476.7	-13625,0	135752.9	0.065
MPV	-0.5	0.1	0	.	0.667

Source: The Author (2018)

Table 4. Fibrinogen evaluation

Fibrinogen	Stratafix® M+DP	Vicryl® M=DP	p-value
D1	135.38 ± 41.11	174.4 ± 67.67	0.161
D9	155.29 ± 19.15	159.96 ± 20.56	0.463
Dif D1/D9	17.3 40.3	-14.4 77.2	0.536

Table 5 PCR evaluation

D1	PCR (mg/dL)	0.01± 0	0.01 ± 0	1.000
D9	PCR (mg/dL)	0.01 ± 0	0.01 ± 0	1.000
Dif D1 and D9 PCR		0.0	0.0	1.000

Table 6. Values of each inflammatory parameter scores analyzed to classify the inflammatory phase of the histological slide ofG1 and G2 groups

Characterizaçtion of the inflammatory process phase according to the final score of each group	
Inflammat. process	Classification final score
Acute	-9 to -3
Subacute	-2.9 to 3
Chronic	3.1 to 9

Table 7; values regarding the scores obtained from the analysis of dataobtained in the histology

		Vicryl®		Stratafix®		
		N	%	N	%	p-value
Vaginal apex	-2	0	0.0%	1	6.2%	0.601
	-1	2	12.5%	3	18.8%	
	0	4	25.0%	2	12.5%	
	1	2	12.5%	2	12.5%	
Aponeurosis	-2	1	6.2%	1	6.2%	0.931
	-1	5	31.2%	4	25.0%	
	0	1	6.2%	2	12.5%	
	1	1	6.2%	1	6.2%	

A percentage reduction was seen in the number of neutrophils on both groups from the pre to the post-surgery periods. The animals in the group Stratafix® showed 37.5 % before the surgery and 26.38 % after it (P =0.574), while the animals in the group Vicryl® presented37.13 % prior to the surgery and34.13 % after it (P = 0.574).

Histological analysis: After the histological analysis of 4 fields in each of the slides obtained from the 16 animals, optical microscopy with the 40X, 100X and 400X objective lenses was used to quantify the inflammatory parameters followed by the classification of the inflammatory phase (TABLE 6), the results found were organized in a Table using

the Microsoft Excel. Regarding the histological study, groups G1 (Vicryl®) and G2 (Stratafix®). G1 P = 0.601 and G2 P = 0.931 resulting in an inflammatory process in the subacute phase in both groups, with a P> 0.05, being considered as sub acute in relation to the characterization of the inflammatory process phase according to the final score of each animal. Regarding the study of fibrosis and fatty encapsulation, 100% of the animals in both groups were classified as grade 1 (Capsule or inflammatory process with less than 0.5 mm).

DISCUSSION

In relation to the fibrinogen measurement, it is known to be an acute phase protein synthesized by the liver, whose plasmatic concentration increases under the stimulating action of interleukins (IL-1 and 6) and the Tumor Necrosis Factor, released by the inflammatory process[12]. During the acute inflammation process, the fibrinogen plasmatic concentration increases for several days, reaching a peak between the fifth and the seventh day, however, it does not suffer any noticeable alteration due to factors such as age, sex, physical exercise or bleeding. On the other hand, it can be affected by inflammatory processes (Vecina, 2006). The fibrinogen was measured on D1 and D9, and no significant alteration was observed between the groups stratafix® and vicryl®. The value obtained was in agreement with studies referring to their values in the phase the study was developed. PCR starts to be secreted, mainly by the liver, four to six hours after tissue aggression, it tends to double every eight hours reaching its peak in 36 to 50 hours. It has a plasmatic half life of 19 hours and, even after a single stimulus, (trauma or surgery), it might take several days to go back to its initial level, and for this reason series of measurements along several days are more useful than isolated results.In our study, the measurements were performed on D1 and D9, and no variation was observed in the PCR values between this time interval, which agrees with the studies found in the literature (Teixeira, 2009; Aguiar, 2013). During the inflammatory process, the bone marrow suffers stimuli and the leucogram is characterized by leukocytosis due to neutrophilia, increase in the neutrophil/lymphocyte relationship and deviations to left within around three days. This leukocyte response is variable according to the intensity, inflammation location, animal species and age (Chabot-Richards, 2014)**.** Regarding the inflammatory response, each cytokine reaches its maximum value at different times. Plasma levels of CRP, fibrinogen and leukogram were evaluated in the preoperative and ninth postoperative days, constructing a satisfactory evaluation, demonstrating a similarity of the results, in relation to the two types of threads analyzed (Xie *et al*., 2016).

Whenleukocytosis due to neutrophilia of inflammatory origin is observed, it must be differentiated from the physiological and the stress neutrophilia, since in the physiological leucocytosis, transient neutrophilia occurs without deviation to the left due to the mobilization of the marginal pool of neutrophils as a response to epinephrine release. The monocytes present in the peripheral blood infiltrate in the wound site as a response to the chemotactic agents both at the beginning and throughout the healing process (Mendonça, 2009). In this study, despite the apparent difference, the values do not show significance when considering that in both approaches the total number of leukocytes was high, however, lower than*P*> 0.05 (0.442), but with few rods and without deviation to the left, and the groups were statistically similar in all variables investigated. The monocytes showed a (*P*= 0.050), within normality standards, while the lymphocytes showed (*P* 0.028), however, without relevance when total leukocytes were analyzed (*P*= 0.083), which means that no systemic inflammatory response was found after surgery in the groups investigated. Regarding the histological study of the groups G1 (Vicryl®) and G2 (Stratafix®), G1 *P*= 0,601 and G2 *P*=0,931 resulting in an inflammatory process in subacute phase in both groups, with *P*> 0.05, which was considered as subacute in relation to the inflammatory process phase characterization according to each animal final score. When fibrosis and fat encapsulation where investigated, 100% of the animals in both groups were classified as degree 1 (capsule or inflammatory process smaller than 0.5mm).

Fibrosis and fat encapsulation: When fibrosis and fat encapsulation were investigated, 100% of the animals in both groups were classified as degree 1. Vicryl® (polyglactin 910) presented greater inflammatory tissue reaction from day 7 on when compared with Monocryl (polyglecaprone 25), but in our study, when comparing Vicryl® and Stratafix®, the reaction observed was similar and not significant, and the handling of both was similar, both with suture and knots (Gartti-Jardim, 2013). In our study, we used user friendly absorbable threads and when suturing withVicryl® 910, only two knots were placed, one at the beginning and one at the end of the suture in a continuous suture, without anchorage, while whenStratafix® was employed,no knots were used and in both cases the sutures remained stable, confirming that these are easy to use threads. Vicryl® 901 (polyglactin) is a multifilament braided and well stretched thread, and when the place where it was used was investigated macrophages were found. According to Stewart, Buffington and Wacksman[20], this is an absorbable suture material manufactured from polymers, which are inert, non-antigenic and provoke only a slight tissue reaction during absorption (Stewart, 1990). In our study, we observed that Vicryl® 910 was really invaded by macrophages, provoking a foreign body reaction, however, the presence of local abscesses was not observed, unlike the result of using Stratafix®, which, maybe for the fact that it is a monofilament absorbable thread, some foreign body reaction was identified, however, with lower intensity. In a comparative work between Stratafix® and polypropylene thread, Stratafix® presented lower foreign body reaction than the polypropylene thread (PLP) in the histological evaluation of dog'' arterial anastomosis[21]. When comparing Stratafix® and Vicryl® in this study, this fact was also observed. No difference in the dehiscence of the vaginal cuff, great vaginal bleeding or spotting were observed, but infection was evident between the two groups (polydioxanone and polyglactin 910), with significant reduction of the surgery times for the bidirectional barbed suture (Bogliolo, 2013). In a study reporting uterine surgery, the polydioxanone barbed suture significantly facilitates the myometrial closure and is associated to the formation of adherences and seriousness of the adhesion, which was not different from that using the polyglactin 910 thread 910 (Einarsson, 2011). The Polydioxanone thread, in turn, is indicated to soft tissue approximation, in cardiovascular surgeries, ophthalmic surgeries (except for cornea and sclera), but not recommended in conjugated sutures with prosthesis implant (cardiac valves or synthetic grafts)[24]. In this study, it was used for the suture of vaginal apex and aponeurosis (soft tissues). Neither of the groups evaluated showed suture dehiscence in the vaginal apex or in the aponeurosis. The presence of adherences was observed in both

groups evaluated, however, without significant difference. No local abscesses were observed in the groups evaluated.

Conclusion

The data analysis did not show significant differences between the two groups of animals submitted to surgery, in which two types of thread were used: Strafix® thread and Vicryl® thread, in relation to the parameters analysed: leucogram, fibrinogen, C Reactive protein and histological study, the data obtained showed that there is a similarity between both, which is extremely relevant, as new and better options have always been sought for the surgical time analyzed. Thus, we conclude that, in procedures in which the surgical time is relevant, such as in laparoscopic surgeries, the use of Stratafix® can generate a significant gain in this surgical time, due to the fact that a continuous suture can be performed without stitches, due to the presence of "splinters" that are part of its constitution, as no greater inflammatory response, fibrosis, or systemic inflammatory reaction was found, when compared to the Vicryl. thread, whose suture needs stitches for its stability.

Conflito de interesses

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