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Original Article

Correlation between serum level of cortisol, interleukin-10 and degree of adhesion after laparotomy and laparoscopy in rabbit with abrasion model

Ridwan Mataram[1], Johny Sjoeib[2], Selamat Budiyitno[2]

[1]Peserta PPDS 1 Ilmu Bedah, Fakultas Kedokteran UNDIP/RSUP Dr. Kariadi, Semarang
[2]Departemen Ilmu Bedah, Fakultas Kedokteran UNDIP/RSUP Dr. Kariadi, Semarang

Abstract

Background : *Intraperitoneal adhesions after abdominal and pelvic surgery procedures occurred almost in 95% of cases. This research will prove the relationship between serum levels of cortisol in response to stress with increased levels of IL-10 and the degree of adhesion after laparotomy and laparoscopy*
Methods : *This study is an experimental laboratory, with a post-test design approach using 12 New Zealand rabbits after adaptation for 1 week were divided into 2 groups. The first group (K1) was performed laparotomy with abration the ilium , group-2 (K2) was performed laparoscopy with abration the ilium too. All groups taken its blood sample before and 6 hours after operation to be assessed levels of cortisol with ELISA kit. 6 days after operation (day of 7th) , all group determinate and performed laparotomy, than assessed the degree of adhesion and the level of IL-10 from its peritoneal fluid. Statistical tests were used to assess defferences in the level of cortisol, IL-10 and degree do adhesion between laparotomy and laparoscopy. Data analysis was done using SPSS.*
Results : *There was significant difference in the level of cortisol, IL-10 and degree of adhesion among groups (p = 0.021, p < 0.001, p = 0.002). There were negatif correlation (high) between the level of blood cortisol with IL-10 (r = - 0.805, p = 0.0) and significant negative correlation between the level of IL-10 with the degree of adhesion (r = -0,833, p = 0.001).*
Conclusion : *Laparoscopic surgery can minimize the effects of systemic stress and immune response, so as to lower the incidence of adhesion.*

Keywords : *Degrees of adhesion, cortisol, IL-10, laparotomy , laparoscopy*

Hubungan antara kadar serum kortisol, interleukin-10 dan derajat adesi pasca laparotomi dan laparoskopi pada kelinci dengan model abrasi

Abstrak

Latar belakang : Kejadian adesi intraperitonial pasca prosedur operasi abdomen dan pelvis adalah 95% dari semua kasus. Penelitian ini akan membuktikan hubungan antara kadar serum kortisol sebagai penanda stress dengan peningkatan kadar IL-10, serta menilai tingkat adesi yang terjadi, setelah laparotomi dan laparoskopi.
Metode : Penelitian ini adalah eksperimental laboratorium, dengan desain post test, menggunakan 12 kelinci New Zealand, setelah dilakukan adaptasi selama 1 minggu, dan dibagi menjadi 2 kelompok. Pada kelompok 1 (K1) dilakukan laparotomi dan abrasi pada ileum, sedangkan kelompok 2 (K2) dilakukan laparoskopi dan abrasi pada ileum juga. Pada semua kelompok diambil sampel darah vena sebelum dan 6 jam setelah perlakuan, untuk diperiksa kadar kortisol dengan metoda ELISA. Enam hari (hari ke-7) setelah pembedahan, semua subjek penelitian dari kedua kelompok dilakukan laparotomi untuk menilai derajat adesi yang terjadi dan juga dilakukan pemeriksaan kadar IL-10 dari cairan peritoneum. Uji statistk digunakan untuk menilai perbedaan kadar kortisol, IL-10 dan derajat adesi antara kedua kelompok. Data diolah dan dianalisa dengan mengunakan SPSS.
Hasil : Terdapat perbedaan yang bermakna pada kadar kortisol, IL-10 dan derajat adesi diantara kedua kelompok, (p=0,021, p<0,001, p=0,002). Terdapat korelasi negatif (tinggi) antara kadar kortisol darah dengan IL-10 (r= -0,805, p=0,0), dan korelasi negatif yang bermakna antara kadar IL-10 dengan derajat adesi (r= -0,833, p= 0,001).
Simpulan : Bedah laparoskopi dapat mengurangi efek stress sistemik dan respon imun, sehingga akan menurunkan kejadian adesi pasca bedah.

Kata kunci : Derajat adesi, kortisol, IL-10, laparotomi, laparoskopi

INTRODUCTION

Peritoneal adhesions are fibrous adhesions (connective tissue) between the abnormal peritoneal surface adjacent, between the peritoneum viserale, as well as between the parietal peritoneum with the visceral. Adhesion can cause adhesions between intraperitoneal organs, either between adjacent bowel or adhesions between the intestine with the abdominal wall. [1]

Injury to the cell layer mesothel will result in the release of various cytokines and inflammatory mediators early by peritoneal mesothelium cells and vascular endothelium is injured. Cytokines produced is pro-inflammatory cytokines, such as: IL-1, TNF-α, and IL-6. As a result of the production of these cytokines, it will further stimulate the activity of the blood coagulation cascade system and suppress the activity of PA. Along with the production of these mediators, also stimulated the activation of the kinin system, complement, arachidonic acid pathway (including prostaglandins), the formation of thrombin, and the conversion of fibrinogen to fibrin.

Kinin system and prostaglandins to stimulate vasodilation, increased capillary permeability, phagocytosis of bacteria and other foreign substances by PMN cells within 24–48 hours, and stimulates migration of macrophages and monocyte chemo-attractant through, so debridement and inflammatory processes have been perfect.[2-4]

Proinflammatory cytokines would decrease the activity of peritoneal plasminogen-activator and increases the activity inihibitornya (PAI-1,2,3, Protease, Nexin). The results of this activity through the coagulation cascade system will generate fibrin in the peritoneal cavity. The presence of fibrin will stimulate adhesion formation through increased fibroblast activity stimulated by the growth factor PDGF (platelet-derived growth factor) and TGF-β. Fibroblast cells and also will be deposed mesothel collagen fibers to form a fibrinous adhesion. Therefore this process is the initial phase of the healing process bioseluler the peritoneum.[5-6]

IL-10 is a cytokine secreted by monocytes many, who have pleiotrofik effect on the immune system and inflammation. IL-10 was first known for its ability to inhibit activation and effector function of T cells, monocytes and macrophages. Interleukin-10 is thought to suppress the pro-inflammatory mediators and cytokines that activate peritoneal fibrinolytic processes, reduce neovascularization process, reduce the migration and proliferation of fibroblasts and collagen production thus formed fibrin deposits and prevent the formation of permanent fibrous adhesion.[7-10]

While histiogenesis process is the result of stages or phases of peritoneal healing after peritoneal tissue integration can be restored. Phases seen in the picture 2.4.[10]

In peritoneal healing there is a special thing that distinguishes the healing process of the skin, ie when the initial phase of inflammation and trauma has been resolved or can be eliminated, then the fibrin that is formed will be described again by the fibrinolisis.[28,29] Balance settings on both the process performed by the role of cytokines. After working proinflammatory cytokines and inflammatory etiology causes can be addressed, then these cytokines will decrease its concentration in the peritoneum, because it is not reproducible by cells involved in inflammation. Furthermore, the role are cytokines that have anti-inflammatory functions. These cytokines are IL-4 and IL-10. Due to the increase in the concentration and activity of these cytokines, the activity of plasminogen activatorakan increased, whereas plasminogen activator inhibitor activity would be inhibited. The end result of the process is the process of fibrinolysis, thus fibrinous adhesion described again and do not form permanent adhesion.[11-15]

METHODS

This study is an experimental laboratory, with a post-test design approach using experimental animals as objects of research. Selected types of New Zealand rabbits with body size considerations are quite large so easy when performed laparoscopically. Experiments performed with simple randomized sampling. The study group was divided into two, namely the K1 group as the treatment group rabbits laparotomy group and treatment group K2 group as the group of rabbits were performed laparoscopy.

Sample Population

Experimental animals such as the type of New Zealand male rabbits were physically healthy, age 8–12 weeks with a body weight between 2500–3000 grams. Selection of a rabbit on the consideration of body size is large enough so that action can be expected laparoscopy done well there is an infection on the skin of the abdominal area before treatment, there were no adhesions or peritoneal infection before treatment. Selected male rabbits that were not affected hormonal and pregnancy. 8–12 weeks of age the young rabbits because rabbits are still in young adulthood, have immunological response will be quickly visible. Some previous researchers are also using the same criteria.

Implementation Research

12 male rabbits adapted in the laboratory with individually caged and given a standard feed ration for 1 week ad libitum.

Prior to anesthesia all rabbit blood sample taken for examination cortisol levels before surgery. Anesthesia

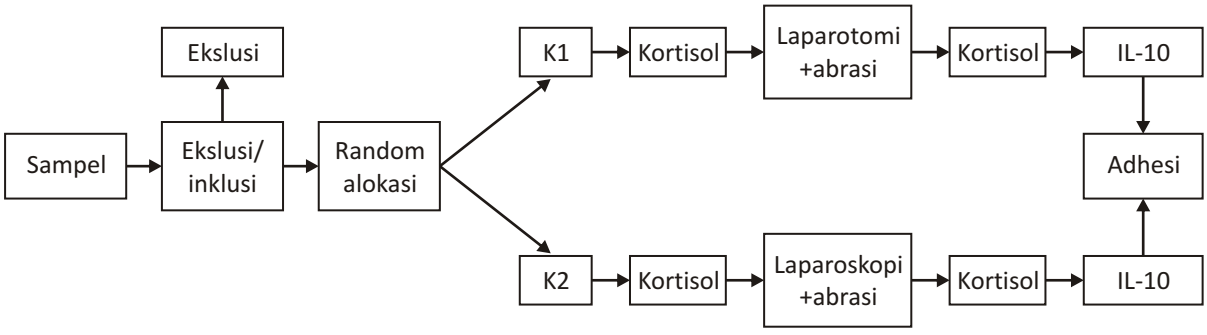


Figure 1. Flow of research process

wears ketamine 20 mg/kg and diazepam 1.5 mg/kg. Actions performed aseptically using sterile instruments. Antibiotic prophylaxis is not given because it can affect the inflammatory reaction.

Treatment in accordance with their respective groups, namely:

a. Treatment group 1, laparotomy and abrasion along the terminal ileum 1 cm proximal from the ileocaecal junction towards, the anti-mesenterial side with laparoscopic forceps, surgical wound was closed with silk sutures 3/0 wear one layer without sewing the peritoneum. Blood cortisol levels checked 6 hours post surgery.
b. Treatment group 2, performed laparoscopically with port size of 1 cm, 0.5 cm and 0.5 cm, and abrasion along the terminal ileum 1 cm proximal from the ileocaecal junction towards, the anti-mesenterial side with laparoscopic forceps, surgical wound is closed with stitches one 3/0 without wearing layers of silk sew the peritoneum. Blood serum cortisol levels checked 6 hours post surgery.

Postoperatively treated rabbits initially stable and get Ceftriaxone 3 mg/100g of body weight intramuscularly every 24 hours for 3 days. Each rabbit that dead after the fourth day of the first postoperative laparotomy/laparoscopy, i performed laparotomy autopsy. While the rabbits that died before the fourth day after the laparotomy/laparoscopy, I excluded from the study and replaced by a new rabbit who meet the criteria. Each rabbit is dead recorded separately. The second laparotomy performed on day 7 to assess the degree of intraperitoneal adhesions. Rabbit is positioned upright (erect) for 15 minutes so that fluid in the peritoneal cavity collected at pelvic cavity. And then laparotomy incision is performed by means of ± 5 cm vertical incision on the left side of the midline, then taken for examination of peritoneal fluid levels of IL-10, and an assessment of the degree of adhesion on the right side (the terminal ileum). Degree examination procedures intraperitoneal adhesions assessed according to the criteria of Nair *et al*.

Data Analysis

The data were processed and presented in tables and Boxplot. To determine the normality test of data normality using the *Shapiro-Wilk test*. When the data were normally distributed and homogeneous, for 2 different test samples were then analyzed using parametric paired *Paired t-test* and to test parametric Pearson correlation analysis. When full-laden parametric analysis is not met then the non-parametric analysis. Limit the degree of significance is that if *p* 0.05 with 95% confidence intervals. Data analysis was done using SPSS.

TABLE 1
Mean of peritoneal adhesion

Group	*n*	Mean±SD
Group K1	6	3.17 ± 0.408
Group K2	6	0.33 ± 0.516

TABLE 2
Adhesion of different test groups based laparotomy and laparoscopy

Group	Laparotomy	Laparoscopy	*p*
Adhesi	3 (3 – 4)	0 (0 – 1)	0.002*¥

* Signifikan $p < 0.05$
¥ *Mann Whitney* test

TABLE 3
Mean of blood cortisol level

Group	*n*	Mean±SD
Group K1	6	25.1 ± 4.127
Group K2	6	18.73 ± 3.920

TABLE 4
Deskriptif and Normality of data Cortisol before and after surgery

Group	Mean±SD	Median (min – max)	*p*
Cortisol before			
Laparotomy	7.28 ± 3.015	7.73 (2.21 – 10.4)	0.583
Laparoscopy	5.13 ± 3.024	4.2 (2.3 – 9.3)	0.207
Cortisol after			
Laparotomy	25.1 ± 4.127	26.3 (17.5 – 29.11)	0.232
Laparoscopy	18.73 ± 3.920	17.75 (14.1 – 23.6)	0.356

TABLE 5
D

Group	Cortisol pre	Cortisol post	*p*
Laparotomy	7.28 ± 3.015	25.1 ± 4.127	0.001*€
Laparoscopy	5.13 ± 3.024	18.73 ± 3.920	< 0.001*€

* Signifikan $p < 0.05$
€ *Paired t test*

TABLE 6
Different test cortisol pre towards post on each - each treatment using Paired t-test

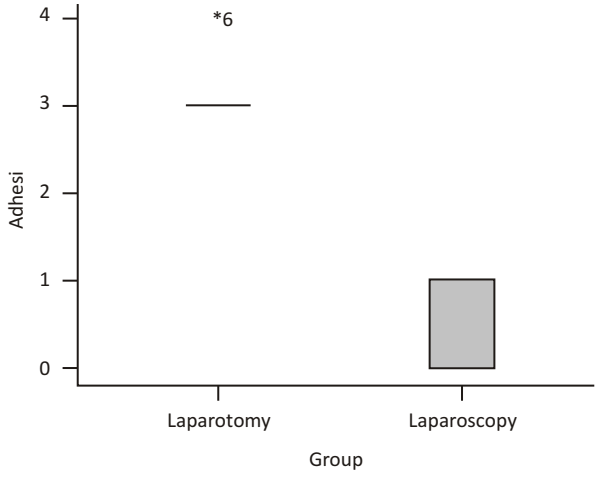
Group	Laparotomy	Laparoscopy	*p*
Cortisol	25.1 ± 4.127	18.73 ± 3.920	0.021*£

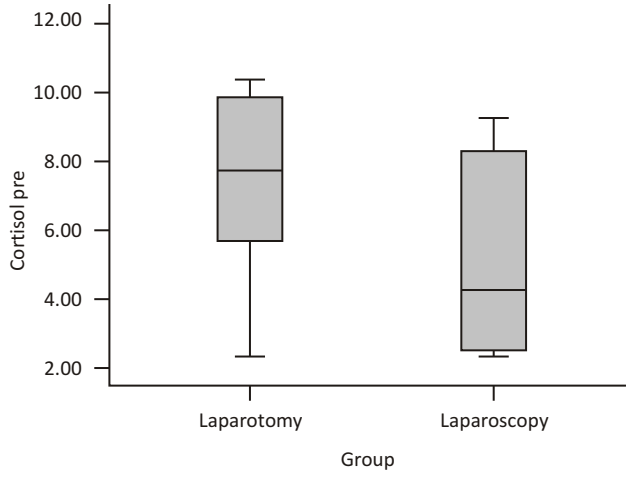
* Signifikan $p < 0.05$
£ *Independent t test*

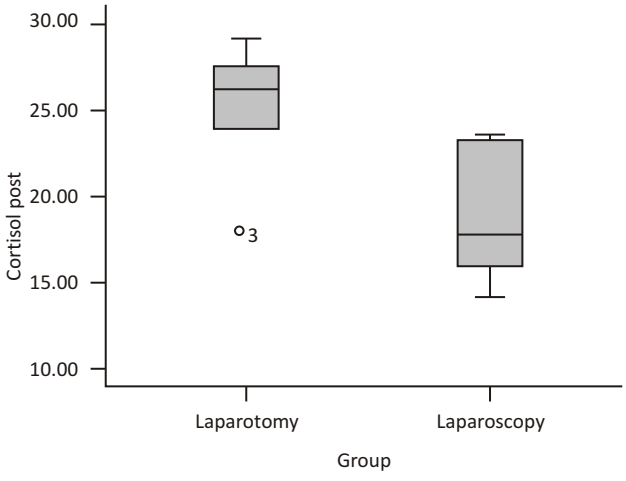
TABLE 7
Different test cortisol pre towards post on each - each treatment using Paired t-test

Group	Laparotomy	Laparoscopy	*p*
Group K1	25,1 4,127	25.1 ± 4.127	0.001*€
Group K2	5.13 ± 3.024	18.73 ± 3.920	< 0.001*€

Result
Treatment group 1 (K1), at the end of the study did not found a dead rabbit or included in the exclusion criteria, so the number of rabbits kept 6 rabbits until the end of the study. The results obtained in this group, intraperitoneal adhesions occurred at grade 3 and grade 5 rabbits rabbits 4 to 1. Total average (mean) increase in cortisol levels 17 827 ± 5477 ng/ml, and the average number (mean) levels of IL-10 peritoneal fluid was 23 445 ± 3512 pg/ml. Treatment group 2 (K2), the amount of 6 rabbits, performed laparoscopically, at the end of the study obtained 1 dead rabbits on day five and still included in the inclusion criteria, the number of rabbits were kept alive until the tail end of the study 5. The results obtained in this group, intraperitoneal adhesions occur grade 0 to 4 rabbits, grade 1 to 2 rabbits. The average amount of







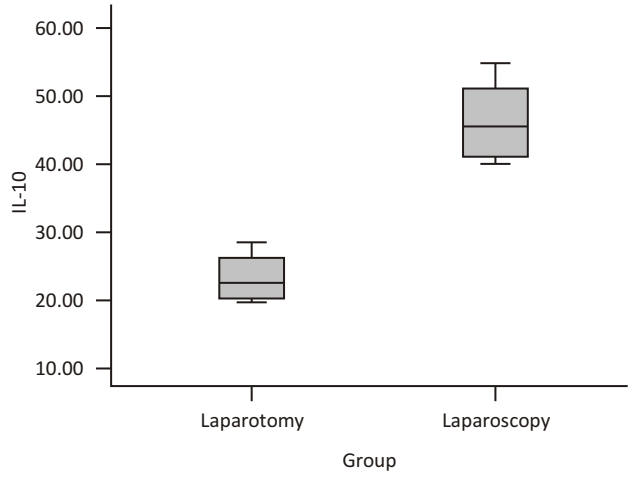


TABLE 8
Nilai Rerata Kadar IL-10 Cairan Peritoneum

Group	*n*	Mean ± SD
Group K1	6	23.445 ± 3.512
Group K2	6	46.493 ± 6.020

increased levels of cortisol 13,600 ± 4,113 ng / ml, and the average number (mean) levels of IL-10 peritoneal fluid was 46 493 ± 6020 pg/ml.

Degree of Peritoneal adhesion

In each treatment group carried out corresponding predetermined. Based on the descriptive statistics obtained by the average degree of adhesion of intraperitoneal adhesions in group K1 degrees is 3:17 ± 0.408; in the K2 group was 0.516 ± 0:33. Showed that the mean degree of adhesion was lower in the group K2 than K1.

Variable degrees of adhesion test for normality with the *Shapiro-Wilk* intraperitoneal (n <50) indicates that the variable is not normally distributed (p <0.05), so as to know the different degrees of adhesion intraperitoneal each group performed a non-parametric test of difference.

Different test using bivariate nonparametric *Mann-Whitney* test (p <0.05) showed that all treatment groups had significant difference with p = 0.002.

Blood cortisol level

In each treatment group carried out corresponding predetermined. Based on the descriptive statistics obtained mean blood cortisol levels of blood cortisol levels in group K1 was 25.1 ± 4.127 ng/ml; in the K2 group was 18.73 ± 3.920 ng/ml. Showed higher mean cortisol levels than those in group K1 K2.

TABLE 9
Different test IL-10

Group	Laparotomy	Laparoscopy	*p*
IL-10	23.445 ± 3.512	46.493 ± 6.020	< 0.001*£

* Signifikan $p < 0.05$
£ *Independent t test*

TABLE 10
Blood Cortisol Levels correlation with levels of IL-10 Fluid peritoneum

Variabel	Mean±SD	*r*	*p*
Cortisol post	21.92 ± 5.078	-0.805	0.002*§
IL-1	34.92 ± 12.878		

* Signifikan $p < 0.05$
§ *Pearson Correlation*

TABLE 11
Correlation Levels of IL-10 Fluid peritoneum with the Degree of Adhesion

Variabel	Mean±SD	*r*	*p*
IL-10	34.92 ± 4.766	-0.855	< 0.001*¤
Adhesi	1.75 ± 1.545		

* Signifikan $p < 0.05$
¤ Spearman *Correlation*

Mean of blood cortisol level
Normality test blood cortisol levels with *Shapiro-Wilk* (n <50) indicates that the variable is normally distributed (p> 0.05).

Homogeneity test variables using Levene's test (p>0.05), the data obtained is homogeneous blood cortisol levels (p = 0.21), so as to know the different blood cortisol levels of each group performed different test parametric.

Different test cortisol pre towards post on each - each treatment using *Paired t-test* (p<0.05) found a significant difference with p = 0.001.

While different test blood cortisol levels post each - each treatment using t-test Independent test (p<0.05), found a significant difference with p= 0.021.

Levels of IL-10 Fluid peritoneum
In each treatment group carried out corresponding predetermined. Based on descriptive statistics levels of IL-10 obtained an average of peritoneal fluid levels of IL-10 in the peritoneal fluid K1 group is 23 445 ± 3512 pg/ml; in the K2 group was 46 493 ± 6020 pg/ml. Obtained results mean levels of IL-10 were higher in the group compared to the group K1 K2.

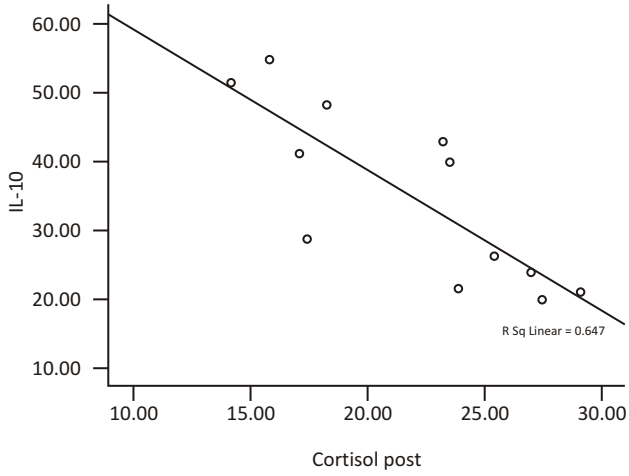
Normality test fluid levels of IL-10 with the *Shapiro-Wilk* peritoneum (n<50) indicates that the variable is normally distributed (p> 0.05).

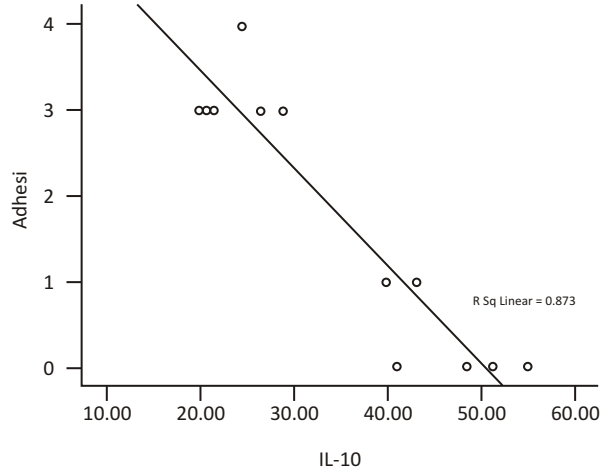
Homogeneity test variables using Levene's test (p> 0.05), the data obtained levels of IL-10 peritoneal fluid is not homogeneous (p = 0.000).

Different test IL-10
Bivariate difference test at variable levels of IL-10 peritoneal fluid by using test Independent t test (p <0.05) found a significant difference with p <0.001.

Blood Cortisol Levels correlation with levels of IL-10 Fluid peritoneum.

Correlation result
Statistical analysis to determine the correlation between the levels of blood koertisol a numeric variable, with levels of peritoneal fluid IL-10 which is also the numerical variables, using Pearson's correlation test correlation (p<0.05). Results of correlation test a significant association with the nature of the strong negative correlation (r = -0. 805) between blood cortisol levels and the levels of IL-10 in the peritoneal fluid of rabbits made





intraperitoneal adhesions with p = 0.002, which means that the higher the blood levels of cortisol, the levels of IL-10 the lower peritoneal fluid.

Correlation Levels of IL-10 Fluid peritoneum with the Degree of Adhesion.

Statistical analysis to determine the correlation between the levels of IL-10 peritoneal fluid which is a numeric variable, the degree of intraperitoneal adhesions that are ordinal variables, using the Spearman correlation test (p=0.05). Correlation test results obtained against a very strong correlation (r = - 0.855) between the levels of IL-10 peritoneal fluid and the degree of intraperitoneal adhesions in rabbits made intraperitoneal adhesions with p <0.001, which means that the higher levels of IL-10 peritoneal fluid, the degree of the lower intraperitoneal adhesions.

DISCUSSION

Intraperitoneal adhesion formation experimentally can be done through various ways, namely ischemia models, the model of peritoneal injury, thermal injury models, with a foreign object, with chemicals and with Abrasion bakterial.[22,29] Ileum in this experiment are included in the model of peritoneal injury. This method was chosen because of an injury caused by abrasion injury resembling the peritoneal injury during surgery of the abdomen. This study aims to prove the existence of a relationship between the type of abdominal surgery as laparotomy and laparoscopy in rabbits with peritoneal adhesion levels with parameters increase cortisol levels and decreased levels of IL-10, where all the rabbits made of abrasion ilium.

The study was conducted on 12 male rabbits of New Zealand, were randomly divided into two groups with each group number 6 rabbits. Six rabbits were performed via laparotomy abrasion ileum (K1), 6 rabbits were performed through laparoscopic ileal abrasion (K2).

The results obtained in group 1, intraperitoneal adhesions occur in 5 grade 3 and grade 4 rabbits rabbits at 1. Total average (mean) degree of adhesion in group K1 is 3:17 ± 0.408, an increase in cortisol levels 17 827 ± 5477 ng/ml, and the average number (mean) levels of IL-10 peritoneal fluid was 23 445 ± 3512 ng/ml. In the treatment group 2 (K2), the amount of 6 rabbits, performed laparoscopically, at the end of the study obtained 1 dead rabbits on day five and still included in the inclusion criteria, the number of rabbits were kept alive until the tail end of the study 5. The results obtained in this group, intraperitoneal adhesions occur grade 0 to 4 rabbits, grade 1 to 2 rabbits. Total average (mean) degree of adhesion of this group is 0:33 ± 0.516 ± 13,600 increase in cortisol levels 4,113 ng/ml, and the average number (mean) levels of IL-10 peritoneal fluid was 46 493 ± 6020 pg/ml. The results of the statistical test (different test) on the degree of intraperitoneal adhesions (p = 0.002), blood cortisol levels (p = 0.021), and IL-10 levels of peritoneal fluid (p <0.001), found significant differences between the groups were performed by laparotomy surgery laparoscopic surgery group. Laparoscopic surgery (minimally invasive) shown to produce smaller effects of stress, the levels of IL-10 were greater, and the degree of adhesion is minimal compared to laparotomy. Results of correlation between cortisol levels and blood levels of IL-10 in the peritoneal fluid of rabbits intraperitoneal adhesions that made a significant association with the nature of the strong negative correlation (r = -0. 805) with p = 0.002, which means that the higher the blood levels of cortisol, the levels of IL-10 the lower the peritoneal fluid.

Statistical analysis to determine the correlation between IL-10 levels and the degree of adhesion of

peritoneal fluid using the *Spearman* correlation test (p<0.05). Correlation test results obtained against a very strong correlation (r = - 0.855) between the levels of IL-10 peritoneal fluid and the degree of intraperitoneal adhesions with p<0.001, which means that the higher levels of IL-10 peritoneal fluid, hence the lower the degree of intraperitoneal adhesions.

Peritoneal adhesions can occur due to trauma to the peritoneum and stimulation peritoneum.Trauma inflammatory response (proinflammatory cytokines; IL-1, IL-6, TNF-α) can be caused by things: trauma surgery, tissue ischemia, infection, reaction allergy, blood, foreign bodies irritating.[22,33]

IL-10 is a cytokine secreted by monocytes many, who have pleiotrofik effect on the immune system and inflammation. IL-10 was first known for its ability to inhibit activation and effector function of T cells, monocytes and macrophages. Interleukin-10 is thought to suppress the pro-inflammatory mediators and cytokines that activate peritoneal fibrinolytic processes, reduce neovascularization process, reduce the migration and proliferation of fibroblasts and collagen production thus formed fibrin deposits can dilisis and prevent the formation of permanent fibrous adhesion.[27]

Adhesion is actually a natural consequence of the surgical trauma and healing. Surgical wound will trigger some reactions that lead to the formation of adhesion through the inflamation process.[2,6]

Surgical trauma stimulates a series of hormonal and metabolic changes in response to stress. Stress will cause the hypothalamus to secrete corticotropic-releasing hormone (CRH) CRH-where it will be heading to the pituitary gland and causes the secretion of adrenocorticotropic hormone (ACTH) into the blood circulation. Will ACTH reaches the adrenal glands and causes the secretion of cortisol and anti-inflammatory effects immunosupresif.[15-20]

Cortisol also has other particular glucocorticoid effects associated with anti-inflammatory activity, which the cortisol accumulation of macrophages and neutrophils mengahambat in the area and can interfere with the synthesis of inflammatory mediators inflamasi.[22,23]

A disturbance in the affinity of fibrinolysis has been known as the cause of intraperitoneal adhesions.[24]

CONCLUSION

There is a significant difference in cortisol levels between rabbits that performed with laparotomy and laparoscopy. Obtained the mean levels of blood cortisol levels in group K1 was 25.1 ± 4.127 ng/ml; in the K2 group was 18.73 ± 3.920 ng/ml. Showed higher mean cortisol levels in group K1 than those K2.

There is a significant difference in the levels of IL-10 between rabbits that performed with laparotomy and laparoscopy. Obtained the mean levels of IL-10 in the peritoneal fluid K1 group is 23 445 ± 3512 pg/ml .; in the K2 group was 46 493 ± 6020 pg/ml. Obtained results mean levels of IL-10 were higher in the group K1 compared to the group K2. Bivariate difference test at variable levels of IL-10 used peritoneal fluid *Independent t-test* (p<0.05) found a significant difference with p<0.001.

There is a significant difference in the degree of adhesion between rabbits that performed with laparotomy and laparoscopy obtained the average degree of adhesion in group K1 is 3:17 ± 0.408; in the K2 group was 0.516 ± 0:33. Showed that the mean degree of adhesion was lower in the group K2 than K1, different non-parametric test used bivariate with *Mann-Whitney* test (p<0.05) showed that all treatment groups had significant difference with p=0.002.

There is a meaningful correlation with the strong negative correlation (r = -0. 805) between blood serum cortisol levels and the levels of IL-10 in the peritoneal fluid of rabbits made intraperitoneal adhesions with p=0.002, which means that the higher the blood levels of cortisol, the levels of IL-10 are lower.

There is a very strong opposite correlation (r = - 0.855) levels of IL-10 between peritoneal fluid and the degree of intraperitoneal adhesions in rabbits made intraperitoneal adhesions with p<0.001, which means that the higher levels of IL-10 peritoneal fluid, the degree of adhesion intraperitoneal are lower.

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