Jurnal Veteriner
pISSN: 1411-8327; eISSN: 2477-5665
Terakreditasi Nasional, Dirjen Penguatan Riset dan Pengembangan,
Kemenristek Dikti RI S.K. No. 36a/E/KPT/2016

Maret 2017 Vol. 18 No. 1 : 31-37
DOI: 10.19087/jveteriner.2017.18.1.31
online pada http://ojs.unud.ac.id/php.index/jvet

Blood Profile of Domestic Cat (*Felix catus*) During Skin Graft Recovery with Different Period

(PROFIL DARAH KUCING LOKAL SELAMA KESEMBUHAN AUTO-SKIN GRAFT DENGAN WAKTU YANG BERBEDA)

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ABSTRAK

Penelitian ini bertujuan melihat profil darah kucing lokal, meliputi sel darah merah, sel darah putih, hemoglobin, hematokrit, dan trombosit selama kesembuhan tranplantasi kulit secara autograft. Sebanyak sembilan ekor kucing lokal (*Felix catus*) jantan umur 1-2 tahun dengan bobot badan 3-4 kg dibagi menjadi tiga kelompok perlakuan. Pada kucing tersebut dilakukan pencukuran rambut dan disinfeksi di area kaki depan sisi lateral, selanjutnya dibuat luka sayat/incisi 2x2 cm. Luka dibalut dengan kasa steril yang dibasahi *povidone iodine* dan dibiarkan selama beberapa hari. Kucing dengan sayatan yang dibiarkan tersebut dikelompokan menjadi kelompok I (dua hari), kelompok II (empat hari) dan kelompok III (enam hari). Transplantasi dilakukan dengan mengambil kulit dari area thorak dan ditempatkan pada resipien dengan terlebih dahulu permukaan luka kulit donor dan dasar luka resipien dibersihkan dari jaringan subkutis. Pengambilan sampel darah dilakukan melalui *vena cephalica antebrachii anterior* pada hari ke-0, 3, 6, 9, 12, dan 18. Berdasarkan hasil penelitian terjadi perbedaan yang signifikan ($P<0,05$) terhadap jumlah sel darah merah, sel darah putih, hemoglobin, dan hematokrit, sedangkan jumlah trombosit tidak menunjukkan perbedaan yang signifikan ($P>0,05$) di antara kelompok perlakuan. Kondisi sistemik tubuh kucing kelompok II dan III lebih baik dibandingan kelompok I.

Kata-kata kunci: profil darah; kucing; autograft

ABSTRACT

The aim of this research is to observe blood profile of domestic cats which includes red blood cell, white blood cell, haemoglobin, haematocrit, and trombocyte during skin graft recovery period via autograft. A total of nine male domestic cats (*Felis catus*) aged 1-2 years weighting 3-4 kg were separated into three treatment groups. Hair shaving and disinfectant application were done on lateral area of front leg, and then 2x2 cm incision was made. The wound was wrapped by sterile gauze dampened by poviderm iodine and left for different period of days per treatment group; where Group I (two days), Group II (four days), and Group III (six days). Transplantation was done by taking the skin on thorax area and placing it on the recipient after first cleaning subcutaneous tissue from the skin surface of donor's wound and the base of recipient's wound. Blood sample was taken from vena cephalica antebrachii anterior on day 0 before skin graft, on day three, six, nine, 12, and 18 after skin graft. Based on the result, significant difference was observed from red blood cell count, white blood cell count, haemoglobin count, and hematocrit, whereas trombocyte count did not show any significant difference between treatment groups. The cats on Group II and Group III were systemic good condition compared to Group I.

Key words: blood profile; cat; autograft skin graft

INTRODUCTION

The advance of oncology surgery to treat skin defects caused by various kinds of trauma shows how the growth of skin reconstruction surgery in cats is developing rapidly. Skin wounds in cats give challenges to cat special veterinarians to develop ways to treat skin trauma in cats. Skin graft in cats needs high precision where wound base must provide appropriate space to place the transplant skin. The transferred skin for transplant must be maintained with granulation source and vascularization. A solid planning with thoroughness, atraumatic surgery technique to minimize tension towards the wound, and bleeding test to measure the transferred skin's life viability need to be done (Nelissen and White, 2014; Thannoon *et al*., 2012).

Transplantation is divided into four techniques, which are: autograft, isograft, allograft, and xenograft. The most commonly used transplantation techniques are autograft and isograft technique. Autograft is transplanting tissue or organ from one part of the body to another within the same individual, while isograft is transplantation which transferred tissue or organs between individuals with the same genetic properties, for example between twins from the same zigot or groups of different animals but still from one ancestry (Andrea *et al*., 2005; Rahal *et al.,* 2007). There are two types of skin graft via autograft commonly used to treat wounds, which are full thickness skin graft and partial thickness skin graft. Incision is needed to adjust the wound edges of the donor with the edge of recipient's wounds and in order to maintain wound flexibility; those are which affect recovery (Ijaz *et al*., 2012; Pressler, 2010).

Surgery wound healing involved cellular and extracellular element. Cellular element consists of red blood cell, leucocyte (neutrophile, eosinophile, basophile), monocyte, lymphocyte, and trombocyte while those in connective tissue are mast cell, fibroblast, monocyte, macrophage, and lymphocyte. Extracellular elements are collagen, elatin, adhesive glycoprotein (fibronectin, laminin, non fibril collagen, tenasen, and proteoglycan). Inflammation process happend to connective tissue with blood vessels filled with plasma, circulating cell, cellular elements, and extracellular of connective tissue (Weiss and Wardrop, 2010). Pre and post operative examination of cat's blood profile are very important in observing systemic physiological condition of cats, so that if physiological disorder were to happen, it can swiftly be treated (Nelisen and White, 2014). This research aimed to observe cat's blood profile feature including red blood cell (RBC), white blood cell (WBC), haemoglobin (HB), haematocrit (HCT), and trombocyte during skin graft recovery period in different time points. The result of this result is hoped to be beneficial for veterinary world and veterinary practitioners treating clinical cases in cats.

RESEARCH METHODS

Ethical Approval. This research has been approved by the Ethics Commission of Veterinary Teaching Hospital, Faculty of Veterinary Medicine, Bogor Agricultural University (IPB) in Indonesian with serial number: 19-2014 IPB.

Research Procedure. This research used nine male domestic cats (*F. catus*) aged 1-2 years weighting 3-4 kgs. The cats were adapted inside individual cages for one month and given feed three times a day and drinking water *ad libitum*. The cats were given amoxicillin and clavulanic acid antibiotic (Claneksi®, Sanbe Farma, Bandung, Indonesia) 62.5 mg/cat, benzoyl metrinodazole (Flagyl®, Boehringer Ingelheim Indonesia, Bogor, Indonesia) 40 mg/kg body weight (BW), praziquantel and pyrantel embonate (Drontal®, Bayer, USA) 5 mg/kg BW. The cats were washed and fasted for eight hours before operation to avoid vomiting, and given atropine sulfas 0.25% (Atropine®, PT Ethica, Jakarta, Indonesia) 0.04 mg/kg BW as premedication and combination of ketamin 10% (Ketamil®, Troy Laboratories PTY Limited, Australia) 10 mg/kg BW and xylazin (Xyla®, Interchemie, Holland) 1 mg/kg BW as general anesthesia. Hair shaving and area disinfection were done on front leg lateral area, followed by first surgery of opening 2x2 cm incision wound. A few days later second operation was done for the skin graft involving group I (two days after first operation), group II (four days after first operation), and group III (six days after first operation). Transplantation was done by retrieving skin from thorax area and placed onto the recipient after first cleaning the donor skin and the base of recipient's wound from subcutaneous tissue. Donor skin and recipient's wound skin were stitched by using silk thread

3.0 afterwards. Transplant area was bandaged by using framycetin sulfate (Sofra-Tulle®, Pantheon UK Limited, Swidon, UK for Sanofi-Aventis, Thailand) and replaced on day 3, 6, 9, and 12 (Mathes *et al*., 2010). For nursing, the cats were given antibiotics, which were amoxicillin and clavunic acid 62.5 mg/cat and flunixine meglumine 1 mg/kg BW for seven days with two times a day interval per administration (Erwin *et al*., 2016).

Blood Sample. Cats were put under anaesthetic ketamin hydrochloride 10 mg/kg BW and xylazine 1 mg/kg BW via intramuscular. Blood sampling was done on day 0 before skin graft, then on day three, day six, day nine, day 12, and day 24 post skin graft followed by bandage replacement. As much as 2 mL blood was taken from vena cephalica antebrachi anterior and placed inside vacuum tubes (Ethylene Diamine Tetra Acid). Afterwards, the samples were brought to the laboratorium for blood profile examination which included RBC, WBC, HB, HCT and trombocyte.

Data Analysis. Quantitative data result from blood profile examination was analyzed by univariate statistic analysis and if differences were identified, Duncan test would follow. All data were processed by using statistical package for social sciences (SPSS) 18 software.

RESULT AND DISCUSSION

Based on statistics test result using analysis of variance, there were significant differences in RBC, WBC, HB and HCT, however they were still within the range of physiological value. On another hand, the analysis of variance test towards trombocyte count did not show significant difference. Examination on RBC, WBC, HB, and HCT and trombocyte done on day 0 before skin graft, three, six, nine, 12, and 18 after skin graft showed significant difference between observation days. The average RBC showed significant difference between treatment groups, treatment group II did not show significant difference with treatment group III and both showed significant difference compared to group I as showed on Figure 1. The decrease of RBC happened on day three and day six. Red blood cell increased again on day nine, day 12, and day 24 post skin graft. The decrease of RBC on group I that was significantly different with group II and III is presumed to be caused by the wound infliction on first operation and second operation for skin graft.

Based on statistical analysis there were significant differences of WBC on each observation day, however still within normal range. The average of WBC on group II was not

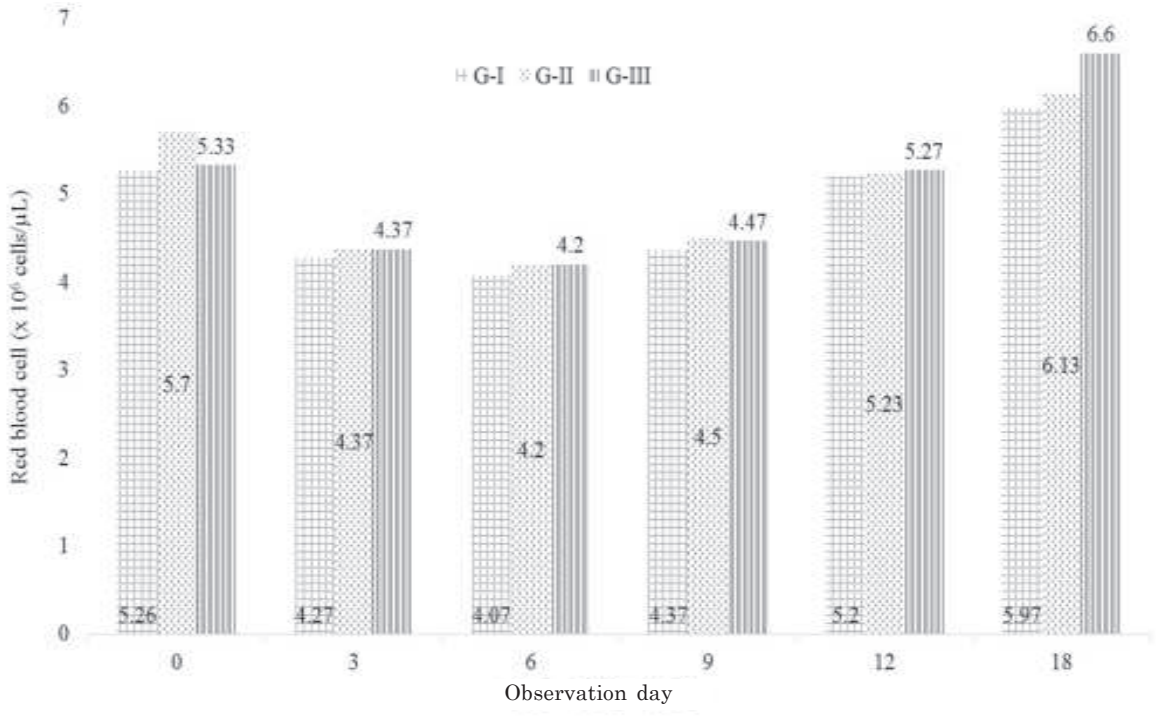

Figure 1.The average of red blood cell count between each observations day and treatment group.

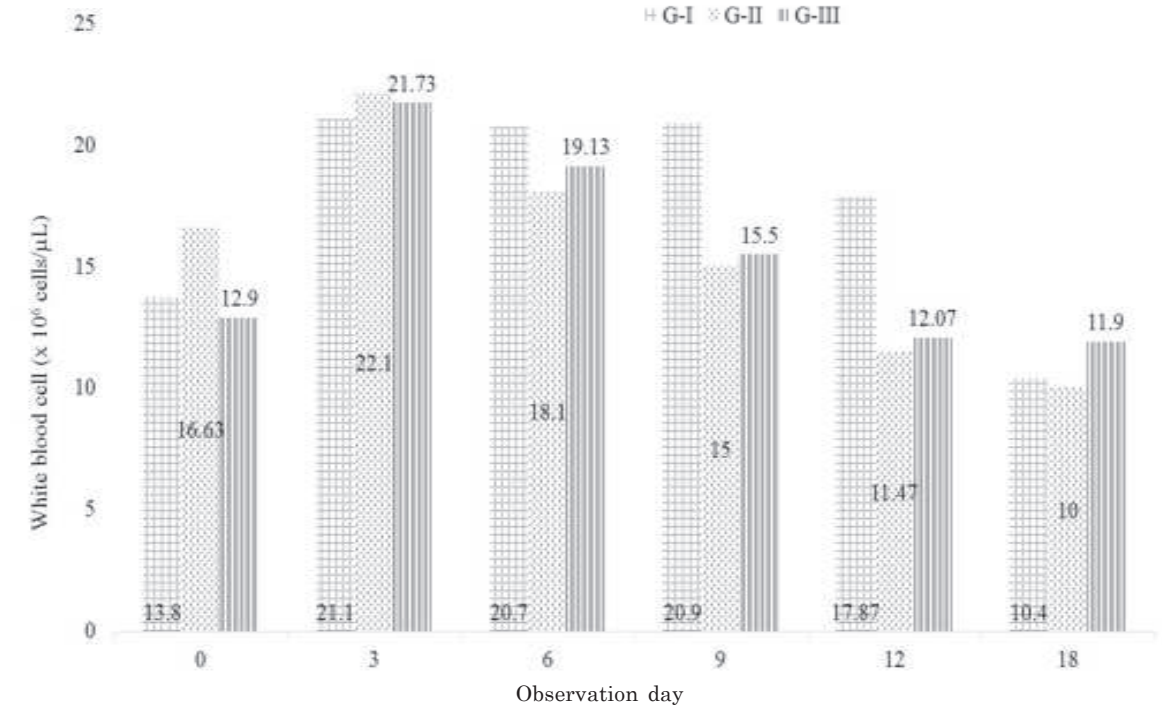

Figure 2. The average of white blood cell count between each observations day and treatment group.

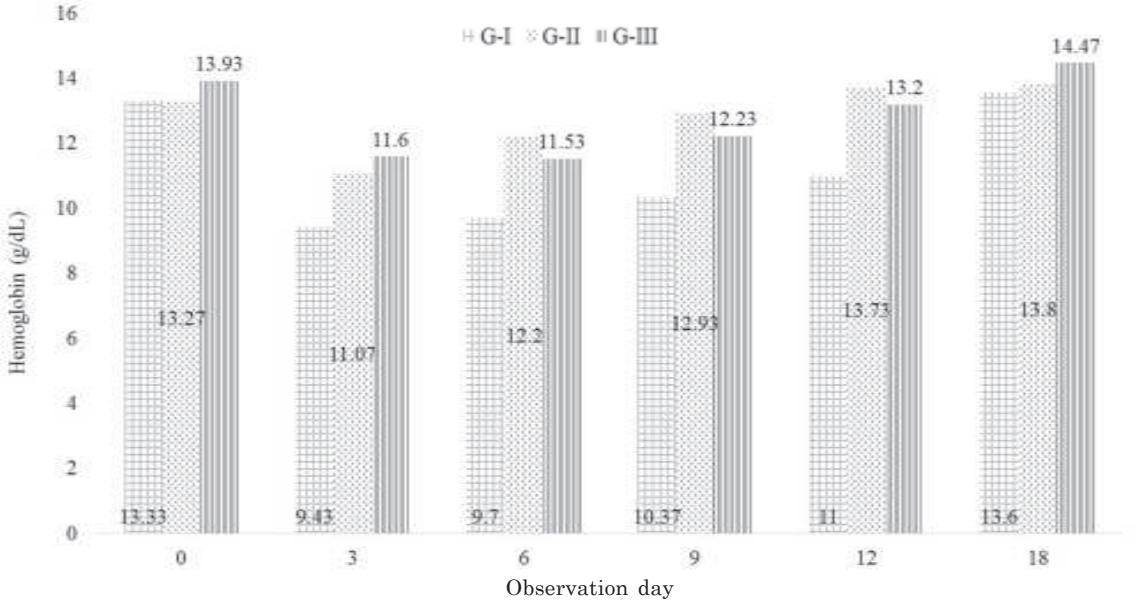

Figure 3. The average of haemoglobin level between each observations day and treatment group.

significantly different with group III and both were significantly different with group I as shown in Figure 2. The increase of WBC on group I was because granulation had not settled yet on the surface of the wound, that it was not ready to accept donor skin. Donor skin would turn into foreign antigen to the body. On day six the average WBC count had started to go down although not significantly different with day three. The average WBC on day 0 pre-. transplantation was not significantly differet with day 12 post transplantation

Average HB decreased on day three and increased again on day six. The increase of HB to normal range happened on day 24 post skin graft, which is not significantly different with

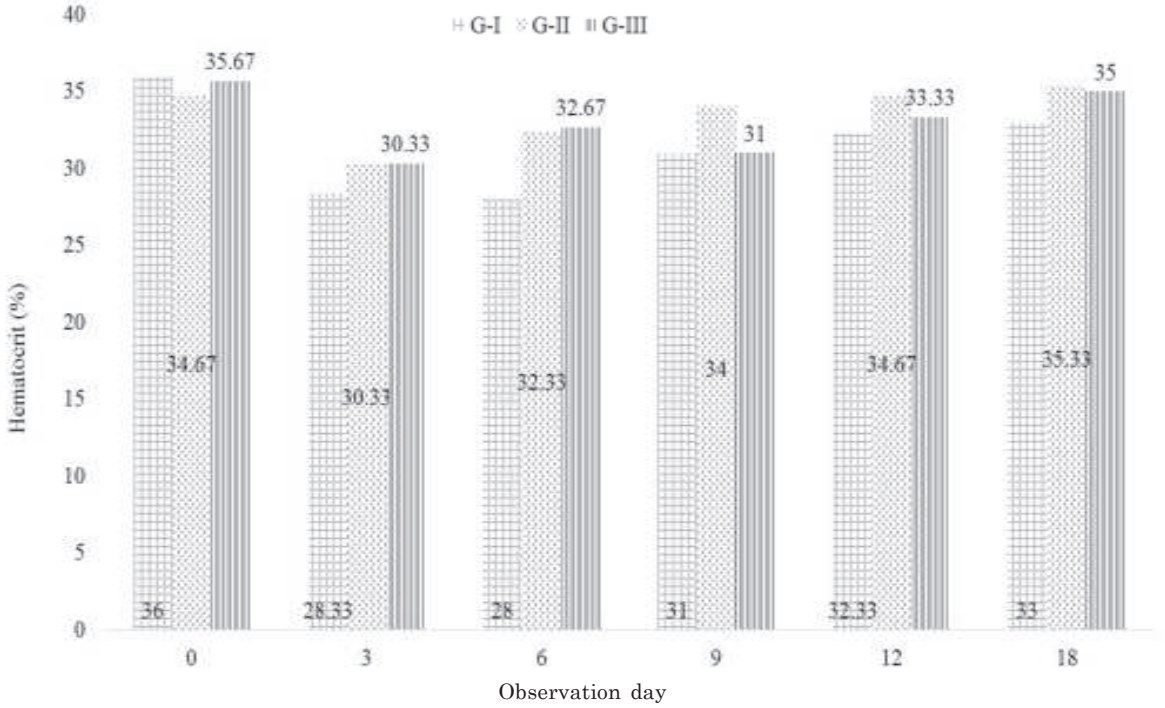

Figure 4. The average of haematocrit between each observations day and treatment group.

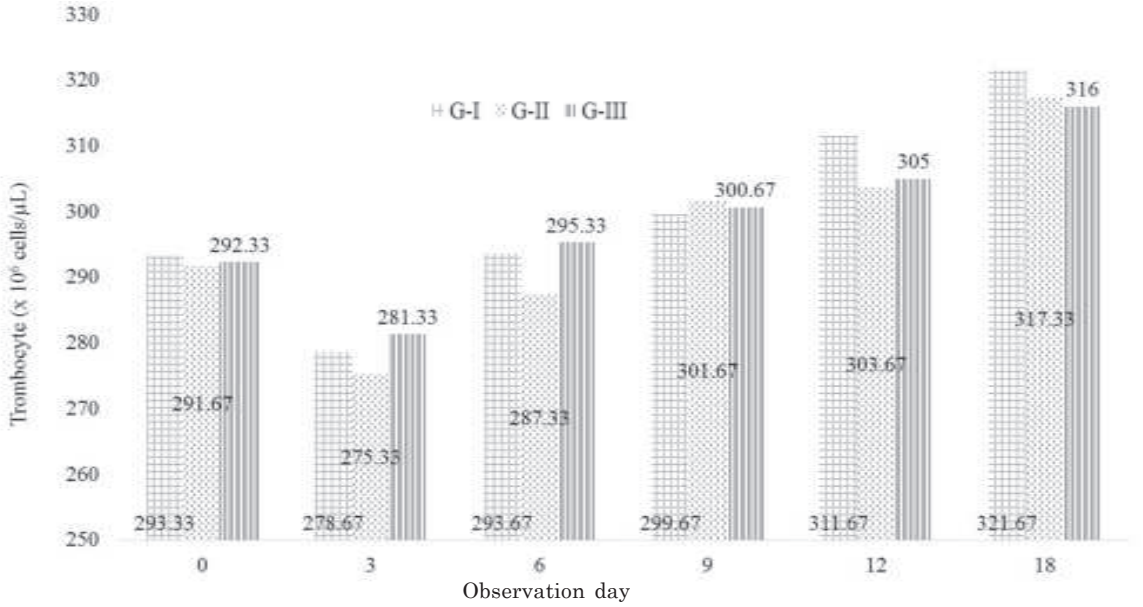

Figure 5. The average of trombocyte between each observations day and treatment group.

day 0 pre skin graft. The change of the average HB between each group was available on Figure 3, which shows significant differences. Lowered HB after skin graft caused cat to lose blood to incision. Examination result towards HCT showed significant difference between each treatment group and observation day. The increase and decrease of HCT on each observation days during skin graft recovery were still within normal range and showed significant different between observation time, as shown on Figure 4. Cats' average trombocyte during skin graft recovery showed significant difference between treatment group and each observation days, as shown in Figure 5. Although trombocyte numbers are statistically different, the numbers

of trombocyte during skin graft recovery are still within normal range.

The decrease of average RBC on day-3 and day-6 after skin graft is presumably caused by the wounding on the recipient and the wounding to retrieve donor skin. During the wounding of the skin, a lot of blood vessels and tissues were cut, which cause RBC to decline. In addition the decline of RBC was also caused by inflammation phase which happened a few early days after wounding, which made cats to be in pain and lowered their appetite. Increase of RBC count started to happen on day 12 and day 24 post transplantation. This was because the body tried to restore physiological condition (Erwin *et al*., 2015). Bone marrow is the connective tissue responsible for eritropoiesis. If the body did not respond to RBC loss, anemia from bleeding may happen. Proliferation and differentiation of eritroid cell and its components were accompanied by a decrease in proliferation ability an increase eritroid specific gene expression. The chain of eritroid proliferaton and differentiation are: increase of growth factr by receptor, activation of membrane protein kinase, phosphorilation of cytoplasm by receptor between other molecules, activation and transcription factor, and transcription factor responsible for red blood cell synthesis (Weiss and Wardrop, 2010).

The increase of WBC on day three was caused by the rise of cortisol hormone evoked by stress during restrain, drug adminitraton, Elizabethan collar setting, and post operative treatment. The cat is included as easily stressed animals compared to other animal species. Stress caused epinephrin release which evoked movement of white blood cel from marginal granulocyte pool (MGP) into circulating granulocyte pool (CGP), which lead to the increase of WBC within the circulation. Increase of WBC number post skin graft is a common occurence, because the body tries to fagocytose and eliminate entering foreign antigen. White blood cells are responsible of body defenses when foreign antigen exist. White blood cell number in the circulation will increase upon stimulation of myeloid tissue activity to produce more white blood cells into the circulation. The use of flunixine meglumine as non-steroid anti-inflammation drug was in order to lower body immunity, so that on day 12 (group II) post transplantation donor skin could already be accepted by recipient (Erwin *et al*., 2016; Fowler 2006; Thannoon *et al*., 2012).

The decrease of HB in this research was still within normal range. Lowered HB under normal range in long period could cause hypoxia which would end with tissue death (Weiss and Wardrop, 2010). Haemoglobin is a protein molecule within red blood cell which transports oxygen and carbon dioxide into the tissue through blood circulation. Nelissen and White (2014) stated that skin graft looked dark and swelling for the first 48-72 hours post transplantation, because of imbibition process of HB product degradation. Furman *et al*. (2014) declared that if under RBC 5.5 x 10^6 cells/μL, HB 9 g/dL, HCT 27 %, it would be classified as anemia.

The decrease of HCT was caused by cat losing fluid during first and second operation for the skin graft, and also HCT decrease may happen because the animal was under stress caused by pain which will in turn lowered appetite and desire to drink. Hematocrit examination after sugery is required to identify the presence of anemia (Erwin *et al*., 2015). Cats are relatively easy to contarct anemia compared to dogs, for their lower blood volume (66 mL/kg compared to 90 mL/kg in dgs). In cats, post operative anemia commonly multifocal and the mechanism is usually through bleeding and haemolysis (Nelissen and White, 2014). Weiss and Wardrop (2010) stated that red blood cell formation is followed by haematocrit increase, which will be followed by haemoglobin concentration increase. If haematocrit count is below 20%, blood transfusion is needed.

CONCLUSION

Changes of blood profile markers in cat during skin graft recovery portray cat's systemic condition. Based on blood profile examination, skin transplatation using full-thickness skin graft (autograft) technique is feasible to be done on cat. Recommendations on the best time to attach donor skin in sequence are Group II (very recommended), Group III (recommended) and Group I (not recommended).

SUGGESTION

Further research is needed to compare the use of moist and dry bandages to auto healing skin graft on the local cats. The use of proper bandage accelerating healing of skin graft.

ACKNOWLEDGMENTS

The authors are highly thankful to the Dean Faculty of Veterinary Medicine, Syiah Kuala University, Indonesi. The Indonesian Ministry of Research, Technology and Higher Education for Research Grant No. 016/UN11.2/LT/ SP3/ 2015.

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