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THORAX RADIOGRAPHY INTERPRETATION OF THE DOMESTIC PIG (SUS DOMESTICA) ON THE PREOPERATIVE, SIMPLE FILTRED INTRAOPERATIVE AND CELL SAVER INTRAOPERATIVE BLOOD AUTOTRANSFUSION

Veterinary Science

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ABSTRACT

The study was conducted to analyze impact on the preoperative blood autotransfusion (group I/AP), simple filtred intraoperative blood autotransfusion (group II/AIS), and cell saver intraoperative blood autotransfusion (group III/AIP). Nine domestic pigs (AP 16.8 kg; AIS 21.5 kg; AIP 28.5 kg) were assigned into three treatment groups. Autotransfusion was conducted after bleeding has reached 30% by splenectomy for inducing abdominal trauma. Analysis of this study conducted through interpretation of the radiographic images. The presence of Acute Respiratory Distress Syndrome (ARDS) was discovered as pathology abnormalities. Based on the radiogram, that abnormalities characterized by the occurrence of pathological changes the pattern of vascular dilating pulmonary vein, interstitial pattern as peribronchial pattern, alveolar pattern of cotton like density and pulmonary edema. The most of prevalence pathology abnormalities was discovered in the group AIS (dilation of the vena pulmonalis = 1/3; peribronchial pattern = 3/3; cotton like density = 1/3; pulmonary edema = 1/3) when the post torakotomi has occured.

KEYWORDS

ARDS, autotransfusi, domestic swine, thorax radiography

INTRODUCTION

At this moment usually a blood transfusion with substitute blood often uses homologous blood. Homologous blood is blood from donors or derived from the blood bank and not from the individual's own blood. The problems encountered from the use of homologous blood is the cost of screening blood donors. The purpose of the blood screening is to prevent the risk of infection from donor to recipient. Another problem that can be found is the presence of immunological reactions between antigens of blood donors with recipient blood antibody or vice versa (Widjanarko 2002).

One of the alternatives that can be done to handle the availability of blood is homologous replacement of the blood extravasation in trauma patients with autologous transfusion. Transfusion of autologous is blood transfusion which is derived from the same individual or also called autotransfusion. Patients with abdominal trauma generally require blood as much as 1.5 to 2 liters are needed in a short time. Therefore, we need a very rapid availability of blood among others through autologous transfusion. The greatest advantage of autotransfusion trauma patients is the availability of autologous blood in a relatively short time (Widjanarko 2002).

Autotransfusion with washing and simple intraoperative autotransfusion have the same procedure, but relatively simple intraoperative autotransfusion have an easier procedure in execution, retrieval, storage and autotransfusion on patients. Autotransfusion with laundering more implemented in developed countries, but in developing countries that have facilities are relatively limited transfusion expected with a simple intraoperative autotransfusion can be a solution and suppress the possibility of side effects appeared compared with autotransfusion laundering. Another advantage is the absence of immunological reaction (Limas and Hanafi 2010).

However, other side effects of autotransfusion that can happen is an inflammatory reaction in the lungs in the form of Acute Respiratory Distress Syndrome (ARDS) and acute renal failure. In the occurrence of ARDS, cytokines have a significant role. However, information about how much influence the simple intraoperative autotransfusion against inflammatory reaction in the lungs and heart is so far still very limited (Krohn et al.1999).

Radiology interpretation as a risk parameter of an autotransfusion side effects must be tested. Thus, the taking of the radiological picture as a risk parameter of side effects must be done.

MATERIALS AND METHODS

Research conducted on animal models of local Indonesian pig (Sus domestica) as many as nine pigs with an average weight of 16.8 kg ± AP group; AIS ± 21.5 kg; AIP ± 28.5 kg, male sex, and age of 3-6 months. This study using X-ray machine for stationary (General X-ray beam), the film cassette equipped with intensifying screens and Röntgen film size of 24 x 30 production Fujifilm, apron, hanger, light illuminator, cell saver tool (Haemonetics Cell Saver® 5, THE Blood Management Company), a set of major surgical tool, a set of inhalation anesthetics, anesthetic ketamine 10% (Ilium ketamil®-100, Troy), xylazin 10% (Ilium xylazil®-100, Troy), and zoletil 5% (zoletil®, Virbac), ETT (Endo Tracheal Tube), suction apparatus (Asahiilca®), sewing thread of silk material and catgut 3/0 size, triangular and round needles, infusion (Infusion Pump OT-701, JMS), the catheter butterfly (IV-catheter), thermometer, stethoscope, syringe, cotton / tampons, plaster, razors, alcohol 70%, and worming oxfendazole 5 mg / kg (Verm-O®, Sanbe).

Pigs are grouped into three groups: control (group AP) transfusion using blood from the bank, the group with simple intraoperative autotransfusion treatment (group AIS) and autotransfusion with laundering (AIP group). Each group consisted of three pigs. Animals were placed in group cages measuring 4x3 meters. Pellet feed is given every morning and evening after a physical examination.

Pig with AP blood group will be autotransfused extravasationed 14 days in advance. Blood stored in the blood bag CPDA (Citrate, Phosphate, Dextrose, and adenine), then put in the fridge. Pigs AIS group treated blood autotransfusion using filtering results manually. Pigs AIP group treated blood autotransfusion using cell saver tool laundering. Autotransfusion done after bleeding 30% by splenectomy. The blood is 30% of pig's blood volume (61-68 ml / kg).

Before treatment, first anesthetized pigs using a combination of ketamine anesthetic and xylazine. Shortly after the pigs anesthetized

performed radiographic image captured using two standard view of the ventro lateral dorsal and latero. KVp values used between 66-74 kVp, depending on the thickness of the tissue that will be penetrated by X-rays. MAs value used is 2.5 mAs.

Filming radiographs performed four times in one series of treatments. The first filming was made when pigs anesthetized perfectly before autotransfusion (H0). The second filming was made shortly before thoracotomy surgery that was two days after the pig was bleeding 30% and has made splenectomy (H + 2). The second image capture was done to observe the initial impact of autotransfusion. Third radiographic image capture was done after surgery thoracotomy (H + 2 ') and seven days after autotransfusion done shooting the fourth (H + 7).

In the Rontgen photo collected, radiographic evaluation and interpretation of radiographs was performed with the help of light illuminator. The interpretation that was done radiographically was on the assessment of lung fields. The assessment radiographically on the lung fields was to see the changes in lung radiogram with changes in the vascular pattern in the form of pulmonary venous dilatation, interstitial pattern in the form of peribronchial pattern, alveolar pattern in the form of cotton like density and pulmonary edema (O'Sullivan and O'Grady 2010).
The results obtained was in the form of qualitative data using the scoring method. The sign "-" declares the absence of clinical findings on the radiographs. Value "1/3" declares the existence of clinical findings in an individual of the three individuals in each - each group, the value of "2/3" on the two individuals and the value of "3/3" if the clinical findings are found in all of the individual groups.

RESULTS AND DISCUSSION

RESULTS

The results of the analysis of radiographs showed the influence of autotransfusion action against radiographs in the thoracic region. In radiogram, pathological changes were found including the pathological changes of vascular pattern in the form of pulmonary venous dilatation, interstitial pattern in the form of peribronchial pattern, alveolar pattern in the form of cotton like density and pulmonary edema.

Table 1. The findings of deviation on each group of treatment

Deviation	SP	Treatment Group											
		AP				AIS				AIP			
		1	2	3	4	1	2	3	4	1	2	3	4
Dilatasi Vena Pulmonalis	VD	-	-	-	1/3	-	-	1/3	1/3	-	-	-	-
	LL	-	-	-	1/3	-	-	1/3	1/3	-	-	-	-
Peribronchial Pattern	VD	-	-	2/3	1/3	-	2/3	3/3	2/3	-	1/3	-	-
	LL	-	-	2/3	1/3	-	2/3	3/3	2/3	-	1/3	-	-
Cotton Like Density	VD	-	-	-	-	-	-	1/3	1/3	-	-	-	-
	LL	-	-	-	-	-	-	1/3	1/3	-	-	-	-
Edema Pulmonum	VD	-	1/3	1/3	-	-	1/3	1/3	1/3	-	-	-	-
	LL	-	1/3	1/3	-	-	1/3	1/3	1/3	-	-	-	-

1: when the pigs perfectly intoxicated before the autotransfusion (H0), 2: before toraxotomi (H+2), 3: after toraxotomi (H+2'), 4: harvesting (H+7). SP: view standard. Symbol " - " : the absence of clinical findings on the radiograph photo. Value "1/3" states prevalency on the clinical findings on one out of three individu in each group, value "2/3" on two individu and calue "3/3" if clinical findings can be found in all group individu.

Based on the data in Table 1, the dilatation of the pulmonary veins occured in the AP group and AIS. The dilatation of the pulmonary vein was observed at the time of shooting radiography after thoracotomy (H + 2 ') and H + 7 (group AIS). Before dilated, the size of the pulmonary veins was 4 mm and having dilated to 5 mm. In the AP group, the dilatation of the pulmonary veins was observed only when the H + 7. Similar events were not found in the AIP group.

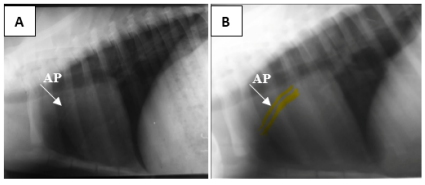

Figure 1. Arteri and vena pulmonalis has the same size in the normal condition (A). The size of vena pulmonalis in the group AIS after toraxotomi experienced dilatasion up to the bigger size from arteri pulmonalis (B). AP: arteri pulmonalis, VP: vena pulmonalis.

The occurance of peribronchial pattern could be found on almost all treatment group. This occurance in group AP was found after toraxotomi and H+7. AIS group showed the peribronchial pattern occurance extraordinarily. After toraxotomi, peribronchial pattern occurance was found on all individu. Peribronchial pattern in AIP group was only found before toraxotomi in one individu in the group.

Genesis peribronchial pattern is found in almost all treatment groups. This incident in the AP group was found after thoracotomy and H + 7. AIS group showed peribronchial incident extraordinary pattern. After thoracotomy, the incidence of peribronchial pattern found in all individuals. Peribronchial pattern on kelompoak AIP found only moments before thoracotomy in one individual in the group.

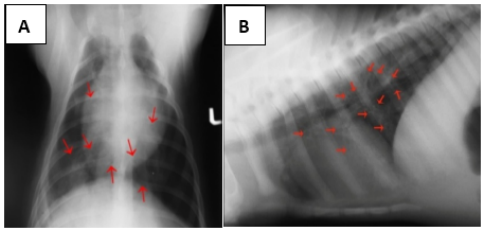

Figure 2. The occurance of the *peribronchial pattern* in the AIS group before toraxotomi. Radiographically, a pattern which has circle shape of radioopak with the centre of radiolusen which look like doughnut will be seen (red arrow) A: view standard ventro dorsal. B: view standard latero lateral.

Genesis cotton like density is only found in the AIS group as before thoracotomy. Similar events are not found in the AP and AIP group of all time radiographic image capture.

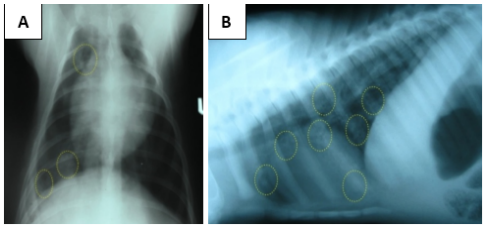

Figure 3. The occurence of *cotton like density* in the AIS group before the thoracotomy is indicated by a yellow circle. Area around the pulmonary capillary looks like radiopaque resembling cotton . A : standard ventro dorsal view . B : standard latero lateral view.

The occurance of edema pulmonum was found in the AP dan AIS groups. Edema pulmonum in theAP group was found before toraxotomi dan after toraxotomi seen in the view standard of *latero lateral* (LL) dan *ventro dorsal* (VD). The same thing was nearly also found AIS group. The occurance of edema pulmonum in AIS group was found before toraxotomi, after toraxotomi and H+7. In the AIP group the occurance of edema pulmonun was not found.

The incidence of pulmonary edema was found in the group of AP and AIS. Pulmonary edema in the AP group found while before thoracotomy and after thoracotomy were seen in the standard view of latero lateral (LL) and ventro dorsal (VD). Almost the same thing is also found in the AIS group. The incidence of pulmonary edema in the AIS group found while before thoracotomy, after thoracotomy and H + 7. On the occurrence of edema pulmonun AIP group was not found.

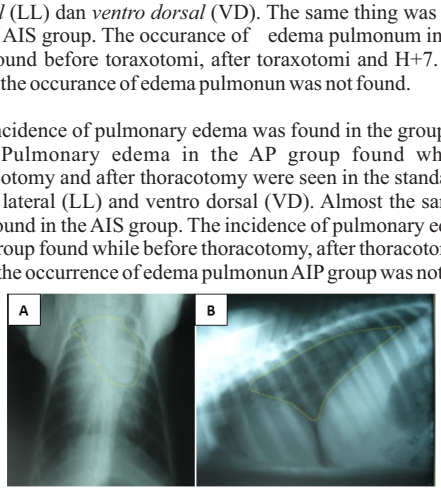

Figure 4. The occurance of edema pulmonum in the AIS group when harvesting (H+7) which is signed with lungs lobus which has more radioopak colour because of the existence of liquid accumulation on

the lobus mentioned. The picture of this radiographic was termed lobar signs (yellow broken lines). A: view standard ventro dorsal. B: view standard latero lateral

DISCUSSION

The figure of radiology on the torax area showed that there were findings on the acute respiratory syndrom or *Acute Respiratory Distress Syndrome* (ARDS). The changes of patology that occured was the influence from the activity of pro-inflamasion cell occured because of the trauma against the red blood component. This trauma happened while autotranfusion process resulting the occurance of lysis cel, as well as the result of bleeding due to trauma of the patients received. In radiogram, pathological changes were found including the pathological changes of vascular pattern in the form of pulmonary venous dilatation, interstitial pattern in the form of peribronchial pattern, alveolar pattern in the form of cotton like density and pulmonary edema. Overall prevalence of the abnormality was found in the AIS group after thoracotomy.

According to Perina (2003), edema pulmonum could be distinguished into two categories, they are: *cardiogenic* and *non cardiogenic*. Edema pulmonum type *noncardiogenicwas also called as* acute respiratory syndrom or *Acute Respiratory Distress Syndrome* (ARDS). The Edema pulmonus type *cardiogenic* occured because of the increase of the pressure of the hydrostatic capiler. On the other hand, the deviation which caused edeme pulmonum type *noncardiogenic* was the increase of permiability of the lungs capiler wall for the protein so that the accumulation of liquid which was rich in protein in the alveolar happened.

The activity of proinflammatory cell which occurs was due to trauma to blood components. This trauma occurs during autotransfusion process resulting in cell lysis, as well as a result of bleeding caused by trauma received by the patients. (Limas and Hanafi 2010). Initial stimulus of the activation of pro-inflammatory cells will activate a chain reaction with the earliest effect is an increase of alveolar capillary permeability of blood vessels and lungs. Liquids with a high content of protein will enter the alveoli, followed by neutrophils and macrophages are activated, and a chain reaction of inflammation begins (Danielson et al. 2008).

CONCLUSION

The radiographic thoracic region showed findings indicate acute respiratory syndrome or acute respiratory distress syndrome (ARDS). Pathological changes that occur are the influence of proinflammatory cell activation that occurs due to trauma towards blood components. This trauma occurs during autotransfusion process resulting in cell lysis, as well as a result of bleeding caused by trauma received by the patients. On the radiogram, pathological changes were found covering the pathological changes of vascular pattern in the form of pulmonary venous dilatation, interstitial pattern in the form of peribronchial pattern, alveolar pattern in the form of cotton like density and pulmonary edema. Overall, the prevalence of most major abnormalities was found in the AIS group after thoracotomy.

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