

COMPARATIVE EFFICACY OF ADVANCED SURGICAL HEMOSTATS IN THE CANINE HEPATOTOMY

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Hepatic surgeries are very common in canines. Hepatic injuries causes serious health issues which may result in death of animals. Liver is a highly vascularized organ and chances of bleeding are very high in hepatic surgeries. Various techniques and materials have been attempted to manage bleeding, but a standard method has not been defined yet. We studied the hemostatic effects of Surgicel Snow and Surgicel Fibrillar in hepatotomy of dogs. The dogs were divided into three groups via group A, B and C with four dogs in each group. All three groups were anesthetized by the combination of xylazine (1.1mg/kg) and ketamine (5.5 mg/kg) administered intravenous. Group A received Surgical Gauze, Surgicel Snow was employed in Group B and Surgicel Fibrillar was used in Group C. Hemostasis time, LFT, CBC, TPR, Ultrasonography were evaluated. Hemostasis time was significantly less in animals who had received a Surgicel Snow compared to Surgicel Fibrillar and Surgical Gauze. LFT values were significantly different among all three groups. CBC values also differ among all groups. In TPR there were no significant differences in all groups. All groups showed no changes during Ultrasonography of liver. Surgicel Snow is better hemostat than Surgical Fibrillar. It is the best hemostat with minimum blood loss and least effects on liver function.

Keywords: Surgicel Snow, Surgicel Fibrillar, Surgical Gauze, Bleeding, Liver, Dog

Hepatic surgeries are very common in canines. Hepatic injuries causes serious health issues which may result in death of

animals. Liver is a highly vascularized organ and chances of bleeding are very high in hepatic surgeries. Bleeding during surgery is a life threatening issue. Despite all recent developments in surgical techniques during liver surgery, blood loss is still one of the main causes for postoperative morbidity and mortality [1].

Hemostasis is the key to successful surgery which benefits the patient, the surgical team and the health care facility. The selection of correct hemostatic agent and the time of its application need understanding of the mechanism of action, efficacy and harmful effects of various hemostatic agents [2].

Approximately half of deaths due to trauma are due to exsanguinations [3]. Bleeding occur in traffic accidents remains one among the most causes of traffic accident deaths. To save the life by stopping or minimizing blood loss until advanced medical care is the main target of healthcare team [4]. Hemorrhage can occur after trauma which can leads to death. It is also the major cause of operating room mortality among patients who undergo liver surgery [5]. After the establishment of safe airway and ensuring the proper oxygenation and ventilation, the best priority in the handling of the trauma. Uncontrolled intraoperative bleeding is a serious complication that can impede both the surgeon's ability to complete the procedure and the patient's ability to recover. Blood that remains intra-abdominally after surgery not only increases the extent and severity of postoperative intestinal adhesions, but also serves as a source of intra-abdominal infections. Inadequate hemostasis increases operative

time, recovery, and length of hospital stay, and constitutes a significant economic burden. Conventional methods used for obtaining hemostasis at continuously bleeding sites include repetitive direct cauterization, placement of sutures or clips, and prolonged direct compression, but these methods can impair tissue healing and recovery through the generation of tissue damage, burn, and necrosis. Conventional methods might also be useless or inefficient in areas that are hard to access or in organs and tissues located nearby that can be easily damaged (e.g. nerves or the respiratory tract). Hence, the development of more effective hemostatic agents is critical in order to keep surgical costs down and provide the best safety for patients [7].

MATERIALS AND METHODS

Dog Selection

12 healthy mongrel dogs of either sex weighing from 12 to 15 kg was arranged from suburbs of Lahore city and maintained in the experimental kennels of Department of Clinical Medicine and Surgery of University of Veterinary and Animal Sciences, Lahore.

Experimental design

The dogs were divided in three groups A, B and C. In all groups a 3 cm long and 1 cm deep incision was given in left lateral lobe of liver. In group A, Surgical gauzes was used to stop bleeding. In group B, Surgicel snow was used to stop bleeding. In group C, Surgicel fibrillar was used to stop bleeding. Prior to the surgery all dogs were kept off feed for 12 hours. Deworming and vaccination of the dogs along with complete clinical examination was done, and prior to initiation of study their temperature, heart rate, respiratory rate, capillary refill time, and general body condition was thoroughly checked.

In all groups Atropine Sulphate was administered subcutaneously at the dose rate of 0.04 mg/kg as a pre anaesthetic; 15 minutes prior to the surgery. Groups A, B and C were generally anaesthetized using 5% Ketamine (inj. Ketazole 50 mg/ml) and 2% xylazine (inj. Xylaz 20 mg/ml)

combination intravenously at the dose rate of 5.5 mg/kg and 1.1mg/kg, respectively [8].

A ventral midline abdominal incision was given starting from xyphoid cartilage up to umbilicus. The length of incision was large enough to permit adequate exposure of the liver. The liver was lying over the stomach and caudal to diaphragm. The left lateral lobe was identified and lifted out through laparotomy incision [9]. A 3 cm long, 1 cm deep incision was given on left lateral lobe of liver and control the bleeding with Surgical Gauze, Surgicel Snow and Surgicel Fibrillar.

Just in closure, the ventral midline abdominal incision was closed in three layers. Linea Alba was apposed by simple interrupted using the absorbable suture material (chromic catgut 2/0-Ethicon). Subcutaneous tissue was closed by using same suture material in simple interrupted fashion. The skin incision was closed by using non-absorbable (Mersilk silk suture 2/0-Ethicon) suture material in simple interrupted fashion.

The following parameters include Hemostasis time, LFT, CBC, TPR, and Ultrasonography were evaluated.

The data was analyzed by various techniques of One Way ANOVA with significance $P < 0.05$ by using Statistical Package for Social Science (SPSS) version 15.0.

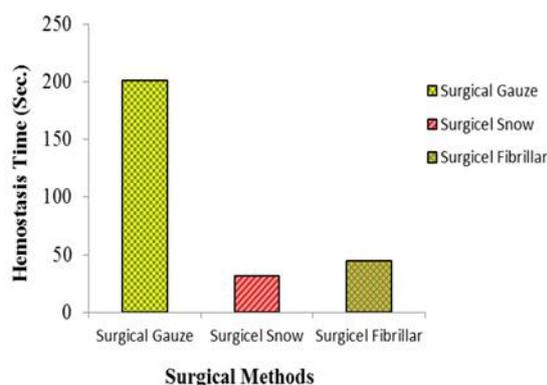
RESULTS

Hemostasis Time Period of Group A, B and C, treated with Surgical Gauze, Surgicel Snow and Surgicel Fibrillar was determined. Results are express in Mean \pm SD, (n=4).

Table: 4.1

Surgical Methods	Hemostasis time (sec)	P-Value
Surgical Gauze	201.00 \pm 5.34***	.000
Surgicel Snow	31.50 \pm 3.10*	
Surgicel Fibrillar	44.50 \pm 2.08**	

Table No 4.1: LSD test showed *minimum hemostasis time **higher



***maximum hemostasis time

Figure No: 4.1: Mean Hemostasis Time of Group A, B and C, treated with Surgical Gauze, Surgicel Snow and Surgicel Fibrillar respectively.

Graphical representation of all three treatment show minimum and maximum hemostasis time. Dogs treated with Surgicel Snow shows minimum hemostasis time followed by dogs of group C and group A.

To evaluate the Liver Function Test of 12 dogs (n=4) treated with Surgical Gauze, Surgicel Snow and Surgicel Fibrillar. Total 36 samples of blood were collected before surgery, after surgery, at 7 day and at 14 day to perform Alanine Aminotransferase (ALT), Aspartate Aminotransferase (AST), and Alkaline Phosphatase (ALP) tests.

For evaluation of ALT, AST and ALP test, blood samples were compared within all three A, B and C groups by applying One-way ANOVA having level of significance ($P < 0.05$) to compare any change among the groups.

Mean values of ALT tests of Group A, B and C dogs (n=4) showed non-significant results. Mean values of AST tests of Group A, B and C dogs (n=4) also showed non-significant results. While Mean values of ALP tests of Group A, B and C dogs (n=4) showed significant results only after surgery. Mean values of RBCs, WBC's, Platelets and Hemoglobin of Group A, B and C dogs (n=4), before and 24 hours after surgery and data were evaluated by applying Paired Sample Test. Only Hemoglobin values showed significant results in group A treated with Surgical gauze. In group B, there were significant differences in RBC's, Platelets and hemoglobin values before and 24 hours after surgery. While in group C only

Hemoglobin values showed significant differences.

Mean Temperature ($^{\circ}\text{F}$), Pulse rate/min, Respiration rate/min of Group A, B and C dogs, treated with Surgical Gauze, Surgicel Snow and Surgicel Fibrillar showed non-significant results.

Ultrasonography was performed at 7 day and 14 day among all 12 dogs (n=4) treated with Surgical Gauze, Surgicel Snow and Surgicel Fibrillar. Ultrasonography was performed by using ultrasound machine HS-1500W, with curvilinear transducer having frequency of 5 – 7.5 MHz. We observed the following parameters, Architecture and echogenicity, Free blood in abdomen, Hepatomegaly, Acute hepatitis. All three groups showed no change in liver.

DISCUSSION

Oxidized regenerated cellulose (ORC) used as an absorbable hemostat since World War II [10]. Surgicel is a sterile bioabsorbable thrombogenic agent used adjunctively in surgical procedures to assist in the control of capillary, venous, and small arterial hemorrhage when ligation or other conventional methods of control are impractical or ineffective [11]. Surgicel use in hepatobiliary surgery where bleeding from small hepatic vessels may be challenging to control [12]. Oxidized regenerated cellulose used to control bleeding in open and endoscopic procedures, including laparoscopic partial nephrectomy [13] laparoscopic cholecystectomy [14] liver and spleen trauma [15]. Oxidized regenerated cellulose may be used for endoscopic procedures, and it may be cut to size to conform to the bleeding site [16]. Davidson and colleagues compared original ORC with autologous fibrin sealant in a swine model of partial hepatectomy and found that ORC and fibrin sealant both significantly reduced bleeding volume and hemostasis time compared to untreated controls [17].

A study was conducted to compare the effect of different hemostatic agents on bone healing in dogs, the authors, suggested that surgicel (oxidized cellulose) was a better hemostatic agent for bone healing compared

to microfibrillar collagen and gel foam and contraindicated the use of bone wax [18]. Other research was performed to check the efficacy of Surgicel that proved effective for the reduction of bleeding after operations such as partial nephrectomy and presacral surgery [19].

The level of change of AST, ALT was high immediately after performing the hepatic operation in patients. These observations coincided with the study reported by [20]. Seven days following the hepatic surgery, both enzymes ALT and AST returned to normal value in patients. The findings are in agreement with the observations of [21]. In the following project LFT, ALP level was measured in which ALP level increased in the transplanted homologous dog liver that showed ALP level increase was the sign of fluctuation in the function of liver [22].

In a research there was a significant decrease in Red blood cell values in patients who were treated with surgery for acute cholecystitis [23]. A study was established to observe an increase of WBC of more than 20.000/ μ l early after OLT orthopedic liver transplantation was associated with patients in which liver was transplanted [24]. Platelets showed fluctuations after liver resection in hepatocellular carcinoma case [25].

An ultrasonographic study was designed to check the febrile formation in the wounded liver resulted in liver dysfunction after laparotomy in rats that showed differences in normal liver after laparotomy in rats [26]. A project was formed to check the liver volume measurement has been reported in dogs with CPSS using radiography, ultrasonography, and CT [27].

CONCLUSION

On the basis of findings of this study: it was concluded Surgicel Snow is best hemostat than Surgical Fibrillar. It is the best hemostat with minimum blood loss and least effects on liver function.

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