NIGERIAN VETERINARY JOURNAL
ISSN 0331-3026
Nig. Vet. J., June 2019 Vol 40 (2): 136 – 146.
https://dx.doi.org/10.4314/nvj.v40i2.6 ORIGINAL ARTICLE

The Complications of Wound Healing on Two Laparotomy Closure Techniques in West African Dwarf (WAD) Goats Undergoing Omentopexy

Onah, J.A.[1*]; Ukwueze, C.O.[2] ; Eze, C.A.[3]

[1]Department of Veterinary Surgery, University of Abuja, Nigeria.[2]Department of Veterinary Surgery and Theriogenology, College of Veterinary Medicine, Michael Okpara University of Agriculture, Umudike,[3]Department of Veterinary Surgery and Radiology, University of Nigeria, Nsukka. *Corresponding author: E mail : Jonasanayo58@yahoo.com; Tel No: +2348067372366

SUMMARY:

Researchers differ on the complications of wound healing using different laparotomy closure techniques. This study investigated the complications of wound healing when peritoneum was and when it was not incorporated in laparotomy closure in omentopexed WAD goats. Twenty WAD bucks were assigned into four groups. Left-flank-oblique-laparotomy was performed in all the goats. In group A goats, the peritoneum was incorporated in the internal abdominal oblique muscle sutures during laparotomy closure. In group B goats, the peritoneum was not incorporated in the muscle sutures during laparotomy closure. In groups C and D, omentopexy was performed and the laparotomy incision closed as in groups A and B respectively. On post-surgery- day (psd) 14, laparotomy was performed in 4 goats from each group, caudal to the initial left oblique-laparotomy, for examination of the sites for tissue adhesions. Serosanguinous exudation observed in goats in groups A and C stopped on psd 6 while that of groups B and D stopped on psd 8. The severity of behavioural signs of pain in each group was recorded using Numerical Rating Scale. Peritoneum-omentum and muscle-omentum adhesions were observed in 50% of goats in group B. 100% and 25% of goats in group C had peritoneum-omentum and rumen-peritoneum adhesion respectively. In group D, 100% of the goats showed peritoneum-omentum adhesion while 50% exhibited other complicated rumen adhesions. In conclusion, incorporating peritoneum into muscle sutures during laparotomy closure in omentopexed WAD bucks has less complications of wound healing than when the peritoneum is not incorporated in the muscle sutures.

Keywords: Key words: Laparotomy closure; wound complication; peritoneum suture; West African Dwarf Goat

INTRODUCTION

The different tissue layers apposed during laparotomy incision closure depend on the experience of the surgeons (Kumar, 2002). Currently, there are contradicting reports on the best tissue apposition technique that facilitates wound healing following laparotomy in animals and man (Fubini and Ducharme, 2004; Zarean and

Zarean, 2006). Generally, veterinarians depend on the healing properties of peritoneum for success of laparotomy (Fubini and Ducharme, 2004). Some literatures opined that suturing laparotomy without incorporating the peritoneum in the sutures has less complication during wound healing while others argue that peritoneum sutured with other tissues develop more complications (Kersjes *et al.,*1985; Milewxzyk, 1989; Slatter, 2003; Fubini and Ducharme, 2004; Zarean and Zarean, 2006). The complications of surgery exercises involving laparotomy and peritoneum may include; bleeding, wound dehiscence, peritonitis, tissue adhesions, excessive exudation, haemorrhage and post-operative pain. These complications may delay wound healing, increase the period of hospitalization, reduce the stock value of the animals and add to the cost of animal production (Arildo *et al*., 2008).

Omentopexy is a surgical practice in large animals and occasionally in small ruminants. It is usually indicated as an adjunct for the correction of left and right abomasal displacement (Aiello,1998), abomasal torsion and abomasal volvulus (Fubini and Ducharme, 2004). The success of this technique depends on the incorporation of the peritoneum in the omentopexy. Omentopexy creates artificial adhesion of the omentum and abdominal muscles. This adhesion serves a live saving function through neovascularisation during the wound healing process (Fox, 1970). However, excess visceral adhesions can result in complications such as peritonitis, omental tear, ventral incisional hernia, pain and subsequently, delayed incisional wound healing (Zarean and Zarean, 2006). Since the parietal peritoneum is liberally innervated by sharp pain nerve endings, it may be that inclusion of the peritoneum in the suture line induces more pain than when it is not included in the sutured line (Omamegbe and Ukweni, 2010).

Hassan *et al*. (2002) noted that wound healing is one of the major reasons clients and patients seek for medical attention. The goal of wound management is to return the affected tissues to their earlier biological functions (Aiello, 1998).

This study evaluated the pain and other complication of wound healing in West African Dwarf (WAD) goats in which the peritoneum was and was not incorporated in the muscle sutures during closure of laparotomy incisions.

MATERIALS AND METHODS

Experimental Animals and Conditioning

This study was approved by the University of Nigeria Ethical Committee with Institutional Animal Care and Use Committee (IACUC) number; UNN/M.Sc/09/51238. Twenty apparently healthy male WAD bucks weighing 6.90±0.40 kg and aged approximately 7 months were used for the study. The goats were kept at normal environmental temperature and natural light/darkness daily cycle. They were managed semi-intensively (tethered in the field for grazing on grasses (*Mucuna utilis, Pennicetum purpureum)* during the day and confined in the pens at night, where their feeds were supplemented with Bambara ground-nut (*Vigna subterrenea L. verda*) waste. Water was provided *ad-libitum* throughout the period of study. They were allowed to acclimatize for three weeks before the commencement of the experimental study.

Experimental Protocols

The goats were randomly assigned to four experimental groups (A, B, C and D) of five goats each. The left paralumbar fossa was shaved liberally with a new razor blade, scrubbed with diluted chlorhexidine gluconate (Purit $^{(R)}$ chemical and Allied product, PLC Agege, Lagos), and scrubbed with 70% alcohol (Gloria-G Pharmacy, Asata, Enugu, Nigeria). The site was draped aseptically in rectangular fashion according to standard (Kersjes *et al.,* 1985). Each goat was administered 50mg of xylazine

hydrochloride (Kepro(R), Holand) at 0.05 mg/kg intramuscularly. Five minutes later, 2% lignocaine hydrochloride (Netagi, Mumbai, India) was administered at 10 mg/kg subcutaneously in inverted "L" technique. A left-oblique-laparotomy incision, 6 cm long was performed on each goat according to standard (Kersjes *et al.*, 1985). During the closure of the incisions, the peritoneum was incorporated in the sutures of the transverse abdominal and the internal abdominal oblique muscle layers of goats in group A, while only these muscle layers of goats in group B were sutured (the peritoneum was not incorporated in the sutures in this group).

In groups C and D, omentopexy was performed by anchoring double folds of the greater omental sac at the transverse abdominal oblique and the internal abdominal oblique muscles, (Kersjes *et al.*, 1985) in a simple continuous suture, using size 2/0 nylon (Helmcare ®, China) suture materials. When closing the laparotomy incisions, the peritoneum was incorporated in the suture of these muscles in goats in group C, while in goats in group D, these muscle layers were sutured without incorporating the peritoneum.

In all the groups A, B, C and D, Both the peritoneum, transverse abdominal and the internal abdominal oblique muscles were sutured using size 2/0 chromic catgut (lifecare®, India) and in simple continuous suture pattern. The external abdominal muscles and the subcutaneous tissues were sutured together using size 2/0 chromic catgut (lifecare®, India) and in simple continuous suture pattern while the skin was sutured using size 2/0 nylon (Helmcare ®, China) and in a horizontal mattress suture pattern.

Clinical Assessment

The sutured sites were monitored for 8 days for bleeding, exudation, wound dehiscence, incisional hernia and signs of post-operative pain (WUWHS, 2007). The behavioural signs of pain were scored in all the groups according to their intensity and percentage number of animals affected in each. They were converted into Numerical Rating Scale and graded as no pain (0), mild pain (1 to 3), moderate pain (4 to 6) and severe pain (7 to 10) (Bourne *et al.*, 2018). The pain descriptors identified included: vocalization and hiding of incision sites on palpation, mutilation of the incision sites by rubbing it on the walls of the pen and licking it with the tongue. Others were: abnormal posture such as kneeling on the forelimbs (praying position), inappetence and reluctant to browse. Four goats from each group were randomly selected on post-surgery day (psd) 14. The goats were administered with 0.05 mg/kg xylazine hydrochloride (Kepro®, Holand) intramuscularly. A 2% lignocaine hydrochloride (Netagi, Mumbai, India) was administered at 10 mg/kg subcutaneously in inverted "L" technique; 3 cm caudal and dorsal to the initial left-oblique-laparotomy, where incision was made for the gross examination of the initial laparotomy incision sites, for tissue adhesions and other post-operative complications. The adhesion was scored grade 0, 1, 2 and 3 as none, mild, moderate and severe adhesion respectively (Table I) based on the severity and percentage of goats involved according to Choudhary and Bansal (2013). The omentopexy was removed, the laparotomy closed in standard procedure (Kersjes *et al*,. 1985) with suture materials as described earlier The goats were administered a mixed solution of Procaine penicillin (10000 iu/kg) and Streptomycin (10mg/kg) (Shanxi Federal Pharmaceutical Company limited, Shanxi, China) intramuscularly for 3 days post-operatively. Piroxicam (Tiangao Pharmaceutical, Hubei China) was administered at 0.3mg/kg intramuscularly for 3 days post-operatively. The skin sutures were removed10 days post-operation and the goats were later disposed

TABLE 1. Grading of Adhesions according to the severity and tissue layers involved.

Grades	Adhesions	Tissues involved
Grade 0	None	None
Grade 1	Mild	Peritoneum, muscle and omentum
Grade 2	Moderate	Peritoneum, rumen and omentum,
Grade 3	Severe	Peritoneum, rumen, omentum and muscle.

DATA ANALYSIS

The data obtained was expressed as percentage of the population exhibiting such signs and presented in tables. The photographs of the tissue adhesions were presented in plates.

RESULTS

Serosanguinous exudate was observed at the skin of the goats around the suture sites in all the groups (TABLE II). In groups, A and C, the exudate was observed from post-surgery day (psd) 1 to 6 while in groups B and D, it was observed from psd 1 to 8. Seropurulent exudate was also observed for one day (psd 4) in one goat in group D.

Only 20% of goats in groups, A and B exhibited behavioural signs of pain (inappetence, mutilation and vocalisation). In group C, 40% of the population showed such behavioural signs (inappetence and mutilation) while 20% showed behavioural sign of vocalisation. In group D goats, 20%, 60%, 40% and 20% of the population exhibited inappetence, mutilation, abnormal posture and vocalization signs respectively (TABLE III).

No adhesion (0%) was observed in all the goats in group A (TABLE IV; Plate 1). Peritoneum-omentum and the muscle-omentum adhesions around the suture sites were observed in 50% of goats in group B (Plate 2). All the omentopexed goats (100%) in group C had peritoneum-omentum adhesions but only 25% of them had in addition, peritoneum-rumen adhesion. (Table IV; Plate 3). All the omentopexed goats (100%) in group D had peritoneum-omentum adhesions while 50% each had muscle-omentum, peritoneum-rumen and muscle-rumen adhesion (TABLE I**V**; Plate 4).

TABLE II. Exudates and number of days it was observed within groups at the skin of the goats around the suture sites when peritoneum was and was not incorporated in laparotomy closure

Groups (n=5)	Exudates			
	Serosanguinous	number of days	seropurulent	number of days
A	+	6	-	-
B	+	8	-	-
C	+	6	-	-
D	+	8	+	1

Keys: + = present: - = absent; n= number of goats in each group.

TABLE III. Percentage (%) of goats that exhibited various behavioural signs of pain in each group

Behavioural signs of pain	Groups (n=5)			
	A	B	C	D
Inappetence	20	20	40	20
Mutilation	20	20	40	60
Abnormal posture	0	0	0	40
Vocalisation	20	20	20	20

n= number of goats in each group

TABLE IV. Percentage (%) of goats that exhibited various tissue layer adhesions at the sutured sites

Tissue layer adhesions	Groups (n=4)			
Groups	A	B	C	D
Peritoneum-Omentum	0	50	100	100
Muscle- Omentum	0	50	0	50
Peritoneum-Rumen	0	0	25	50
Muscle-Rumen	0	0	0	50

n= number of goats in each group

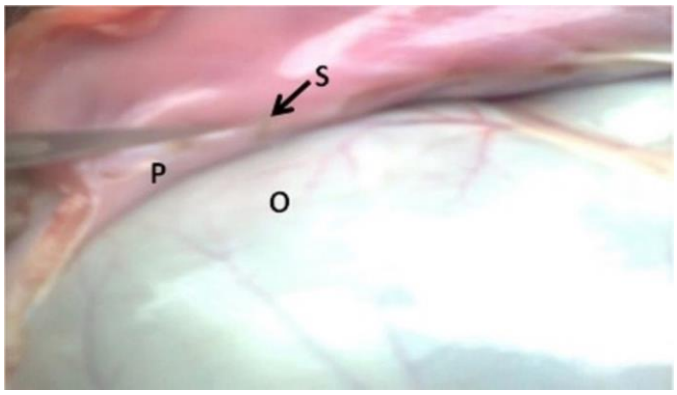

Plate 1: The mediolateral section of the sutured site of the abdominal muscle: Shows the, suture material (S), peritoneum (P), and omentum (O) of **group A** goats, where the peritoneum was incorporated into muscle sutures and without omentopexy

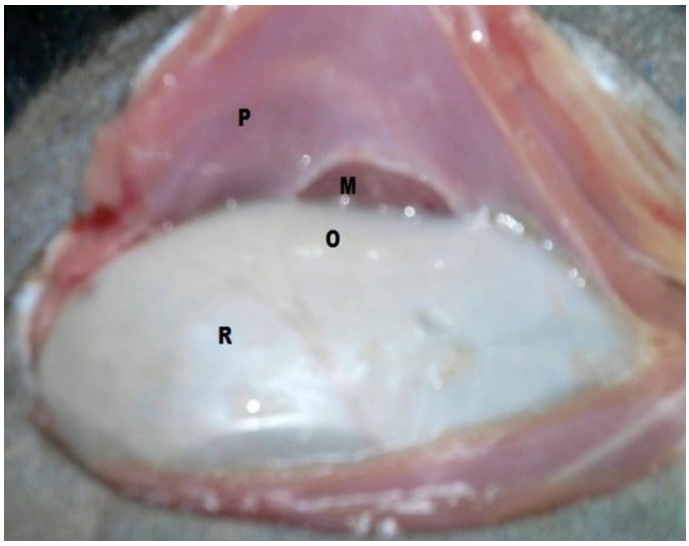

Plate 2: The mediolateral section of the sutured site of the abdominal muscle: Shows the muscle (M), peritoneum (P) rumen (R) and omentum (O) of **group B** goats, where the peritoneum was not incorporated into muscle sutures and without omentopexy

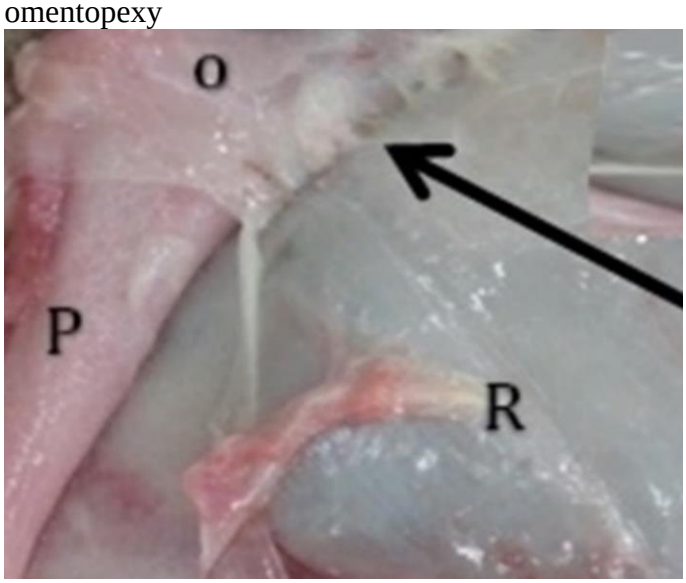

Plate 3: The mediolateral section of the sutured site of the abdominal muscle: Shows the, peritoneum (P), rumen (R) and omentum (O) of **group C** goats, where the peritoneum was incorporated into muscle sutures and with omentopexy. Note the peritoneum-omentum adhesion (arrow).

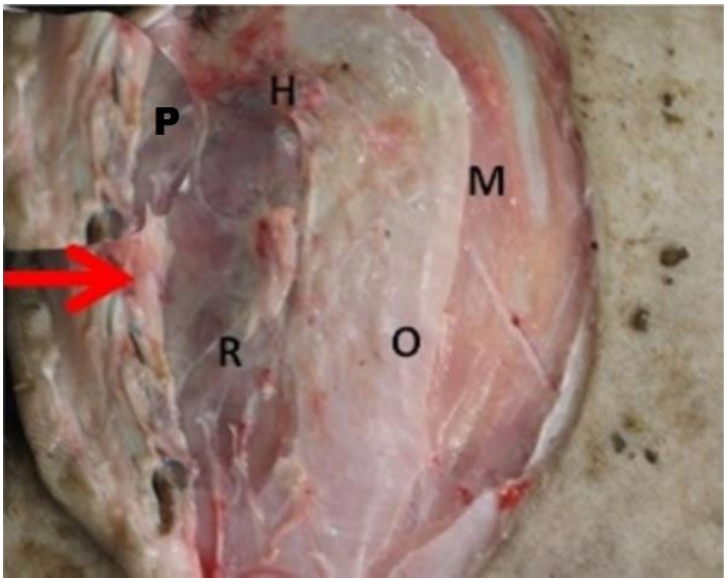

Plate 4: The mediolateral section of the sutured site of the abdominal muscle: Shows the area of haemorrhage (H), muscle (M), peritoneum (P), rumen (R) and omentum (O) of **group D** goats where the peritoneum was not incorporated into muscle sutures and with omentopexy. Note the complex adhesions (arrow).

DISCUSSION

The serosanguinous exudates observed in all the experimental groups (TABLE II) within seven days in this study is suggestive of early acute wound healing process (WUWHS, 2007). The serosanguinous wound exudate keeps wound sites in a moist state and aids migration of tissue replacing cells to the wound sites (WUWHS, 2007). This observation is also in line with the reports of Sunil *et al.* (1998), Stuart and Patricia (2004) and Robin and Fiona (2005), who noted that such fluid provide nutrients for cell metabolism and enables the diffusion of immune growth factors to the wound sites and subsequently facilitate the rate of wound healing.

It was noted that prolonged exudation may delay wound healing (WUWHS, 2007). The wound exudation that was observed for a shorter duration (within 6 days) in groups A and C is an indication of wound healing faster in these groups than those in groups B and D where the exudation lasted for about 8 days (WUWHS, 2007). Serosanguinous exudate of wounds are made up of immunogenic, phagocytic and protein cells that facilitate wound healing, but when lost through excessive exudation for longer durations, may be deleterious to wound healing (WUWHS, 2007). The deficiency of protenious cells of peritoneum and seepage of wound fluid through the non-sutured part of the wound may result in prolonged exudation and delays wound healing (Anderson *et al.*, 1994). Also, Radostits *et al.* (1994) noted that excess exudation results in visceral friction that negatively affects wound healing.

The seropurulent exudate observed in one goat only on psd 4 in group D (TABLE II) was suggestive of infections. Wound healing by fibrosis when peritoneum was not incorporated into muscle sutures during laparotomy closure in WAD goats has been reported (Onah *et al*., 2014). The fluid exudates might have accumulated in the dead space created as a result of peritoneum not sutured (Plates 4), and probably served as a medium for growth of microorganisms. Although the scope of this work did not involve biogram, it might be argued that the observed seropurulent exudate was a phagocytic response to infection. Dwyer (2007) reported that purulent exudates are a combination of denatured protein, neutrophils and wound fluids. However, the duration of the purulence was short which showed that the immune system of the apparently healthy goats was able to curtail the likely infections.

These prolonged exudations and seropurulent exudate were not found in peritoneum sutured goats (groups A and C) indicating that the peritoneum incorporated in the muscle sutures provides less complication and facilitates wound healing (Kersjes *et al*., 1985; Kumar, 2002; Onah *et al.,* 2015).

The pains observed in all the experimental groups (TABLE III) was not surprising because it has been documented that any injury to the tissues of the body stimulates the nociceptive cells and subsequently results in pains (Hansen, 2003; Omamegbe and Ukweni, 2010). The signs of pain (inappetence, mutilation and vocalization) that were observed in 20% of goats in groups A and B as against 40% (inappetence) in groups C goats and 60% (mutilation) in goats in group D (TABLE III) might be as a result of the differences in additional trauma elicited on the pain nerve endings in the omentum by omentopexy. Pain may be a sign of omental stress caused by injury to the omentum (Ebeid and Rings, 1999). Pain in greater percentage of goats in the omentopexed groups (40% in group C and 60% in group D) probably indicated that omental stretch involved the parietal peritoneum which has sharp pain transmitting sensations (Omamegbe and Ukweni, 2010; Bourne *et al.*, 2018). It is possible that wound complications from omental stretch and stress in the non-sutured peritoneum potentiated the severity of pain.

There was no adhesion observed at the incision sites of goats in group A (TABLE IV; Plate 1) which probably indicated that there was no complication at the incision sites. This agrees with the reports of Kersjes *et al.* (1985) and Kumar (2002) that incorporating peritoneum in muscle sutures reduces the risk of complications. Zarean and Zarean (2006) in their study of peritoneum suture and non-suture in man stated that suturing of peritoneum following abdominal incision causes less risk of peritoneal adhesions.

The adhesions observed in goats in groups B, C and D in this study (TABLE IV) might be as a result of proximity of different tissue layers to one another and drainage of wound fluid from incision sites and adjoining tissues. The peritoneum-omentum and muscle-omentum adhesions observed in 50% of goats in group B (TABLE IV, Plate 2) might be as a result of injury to the peritoneum. Such mild adhesions might probably be due to the wound healing role of the untraumatised omentum. Minor injury to the peritoneum causes only transient fibrinous adhesions that have no significant effects on the animals (Fox, 1970). Also, omentum prevents deleterious adhesions and facilitates wound healing (Bhuyan *et al*., 2002; Goldsmith, 2004). In addition, such adhesion serves as a seal against break in continuity of viscera and provides neovascularisation of ischaemic tissues (Weibal and Majno, 1973; Fubini and Ducharme, 2004).

The moderate peritoneum-omentum adhesions found in 100% of the goats in groups C and D (TABLE IV, Plate 3) might have resulted from omentopexy performed in these groups using non-absorbable suture materials. Omentopexy using non-absorbable suture materials creates omental

adhesions that last for a long period of time (Kersjes *et al.*, 1985; Aiello, 1998; Zughluol *et al.*, 2009).

The complex adhesion of muscle and rumen to other tissues such as muscle-omentum, peritoneum-rumen and muscle-rumen found in 50% of goats in group D (TABLE IV, Plate 4), which bled during separation of the adhered tissues, might be evidence of pathologic adhesions. Such pathologic adhesions in a compromised peritoneal tissue result in omental stress, reduced rumen motility, pain and consequently, prolong wound healing. Such observations above have been documented (Fox 1970; Aiello, 1998). Injury to the omentum following omentopexy can interfere with its immunogenic and angiogenic properties, thereby reducing its wound healing potentials (Goldsmith, 2004).

In conclusion, incorporating peritoneum in the muscle sutures during laparotomy closure in omentopexed WAD bucks has less complications of wound healing than when the peritoneum is not incorporated in the muscle sutures.

REFERENCES

AIELLO, S. E. (1998). The digestive system; The Merck Veterinary Manual (8th ed.). Merck and Co; Inc. White House Station, N. J, USA.

ANDERSON, D. F., CORNWELL, D., ST. JEAN, G., DESROCHERS, A., and ANDERSON, l. S. (1994). Comparison of peritoneal fluid analysis before and after exploratory celiotomy and omentopexy in cattle. *Am. J vet. Res.*, **55** (12): 1633-1637.

ARILDO, T. V., FERNANDA, V., ANDREIA, B., PAULO, H. F., and EDURADO, S. G. (2008). Comperative study between partial peritoneum suture and non-suture in midline laparotomies in rats, *Act Cir. Bras*., 23(4): 348-351**.**

BHUYAN, A. A. M., RAHMAN, M. M., HASHIM, M. A., ISLAM 1. M. K., ISLAM 2. A. (2002). The role of omentum in wound healing in goats. Departments of Surgery and Obsterics, Faculty of Veterinary science, Bangladash Agricultural University, Mymensingh, Bangladash. Pp. 1-12.

BOURNE, D; FORBES, A. B; and WHAY, H. R. (2018) Assessment of pain in ruminants (Techniques overview) - *wwildpro. Wildpro.twycrosszoo.org.* Downloaded in 19th August, 2018.

CHOUDHARY, A and BANSAL, N. (2013). Non closure of parietal peritoneum at cesarean section and adhesion formation. *Int J Reprod Contracept Obstet Gynecol*., 2(3): 406-409.

DWYER, l. (2007). Wound management in small animals. A practical guide for veterinarians, nurses and technicians. Bulterworth Heineman (Elsevier) Edimburgh, London. Pp. 1-159.

EBEID, M. and RING, D. M. (1999). Generalized peritonitis in cattle; 31 cases (1993-1997). *The Bovine Practitioners*, **3**: 144-148.

FOX, F.H. (1970). Esophagus, stomach, intestine and peritoneum; Bovine Medicine and Surgery. Am. Vet. Publ. Inc, Illinois, pp. 417- 44.

FUBINI, S. L. and DUCHARME, N. G. (2004). Farm Animal Surgery. Saunders/Elsevier., St. Louise, Missouri, pp. 1 – 609.

GOLDSMITH, H.S. (2004). The evolution of omentum transposition: from lymphedema to spinal cord stroke and Alzheimer's diseases. *Neurology Research*, **26**: 586-593.

HANSEN, B.D. (2003). Assessment of pain in dogs: veterinary clinical studies. *Ilar Journ*. **44**:197-205

HASSAN, A. Z., AMBER, E. I., AWASUM, C. A., REMI-ADEWUMI, B. D., YILA, A.S., HASSAN, F. B., and JAHUM, B. M. (2002). A review of wound healing; *Nigeria Veterinary Journal*, **23** (2): 1-4.

KERSJES, A. W., NEMETH, F., and RUTGERS, l. J. E. (1985). The abdomen. A colour Atlas of Large Animal Surgery. Wolf Medical Publication Limited, London, pp. 29-51.

KUMAR, A. (2002). Surgery of the abdomen and organs of the digestive system. Veterinary surgical techniques. Vikas Publishing House PVT Limited, pp. 264-315.

MILEWXZYK, M. (1989). Experimental studies on the development of peritoneal adhesions in cases of suturing and non-suturing of the parietal peritoneum in rabbits. *Ginekol publ*., **60** (1): 1 -6.

OMAMEGBE. J. O. and UKWENI, (2010). Identification, diagnosis and management of pain in small animals – a review; *Trop. Vet*., **28** (2): 1-29.

ONAH, J. A., EZE, C. A., ABA, P. A., UKWEZE, C.O., and ODO, R.I. (2014). Blood and serum biochemistry of omentopexed West African Dwarf goats following peritoneum sutured and not sutured laparotomy. *Animal Research International*, **11** (1):1881-1888.

ONAH, J. A., EZE, C. A., ABA, P. E., and SHOYINKA, S. V. O. (2015). Histopathology assessment of incisional wound healing behavior of peritoneum-sutured and not- sutured techniques following laparotomy and omentopexy in West African Dwarf goats. *Comp clin pathol.*, **24**:317-322.

RADOSTITS, O.M., BLOOD, D.C., and GAY, C. C. (1994). Diseases of the alimentary canal 1 and 11. Veterinary Medicine; the textbook of the disease of cattle, sheep, pig, goats and horses. 8th ed. Bailliere Tindall, London, pp. 157-312.

ROBIN, R. and FIONA, R. (2005). Repair: wound healing and regeneration. Pathology Illustrated, pp. 99 – 117.

SLATTER, D. H. (2003): Abdominal wall, peritoneum and peritoneal cavity. Textbook of small animal surgery. 3rd edition. Saunders publications, Elsevier.

The Cortis Center, Philadelphia, pp. 405-470.

ENOCH, S. AND PRICE, P. E. (2004). Cellular, molecular and biochemical differences in the pathophysiology of healing between acute wounds, chronic wounds and wounds in the aged. *World Wide Wounds* 1-16.

SUNIL, R. L., FINLAYSON, C. A and DILLY, S. A (1998). Healing; Basic Pathology: 2nd ed. Arnold publisher limited, pp. 48-60.

WEIBAL, M. A. and MAJNO, G. (1973). Peritoneal adhesion and their relation to abdominal surgery. A post moterm study. *Am. J. Surg*., **126:** 345-354.

WORLD UNION OF WOUND HEALING SOCIETY (WUWHS) (2007) Wound exudates and the role dressing: Principle of Best Practice-consensus document. London Mep Ltd. http://www.woundsinternational.com, Accessed 18th May, 2017.

ZAGHLOUL, A. E., KARROUF, G. I., FOUDA T. A, and El-SHAFNEY. (2009). Diagnosis and management of abomasal disorder in cattle. 6th International scientific conference, Faculty of Veterinary Medicine. Mansoura University, Egypt; 87-114.

ZAREAN, Z. and ZAREAN, P. (2006). Non-closure verses closure of peritoneum during caesarean section, a randomized study. *Eur. J. of obstr and gynecol and rep. Bio.,* **126** (1-2): 267.