



## Pathological Assessment of Bovine Liver Abscesses in Basrah Abattoir, Iraq

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**T**HIS study was conducted to examine bovine liver abscesses to identify the pathological aspects of the liver of slaughtered cattle at Basrah Abattoir. Seventy liver samples were collected; sixty samples affected with bovine liver abscesses BLA, and ten healthy liver samples served as control. The hematological results showed a significant ( $P \leq 0.05$ ) increase in total WBCs count, lymphocytes count and neutrophil count of BLA when compared to a healthy. Moreover, the results of the biochemical analysis showed a significant ( $P \leq 0.05$ ) increase of AST, ALT, ALP, and LDH in BLA compared to healthy. The macroscopically study of the liver of BLA showed multiple nodules vary in size which dispersed on the diaphragmatic and visceral surfaces, which showed friable areas and multiple grayish-white abscesses that containing whitish cheesy materials. The histopathological, revealed dilation of the center vein, pericentral inflammatory cells infiltration mainly polymorphic inflammatory cell, besides, marked area of degenerative changes of hepatocyte particular in the pericentral region as well to multiples abscesses areas were found in the hepatic parenchyma particularly in the subscapular region represented by focal infiltration of neutrophils, The portal vein showed dilated cystic like projection and filled with infiltration of inflammatory cells as well to inflammatory exudate; also, there is the infiltration of inflammatory cells around of portal vein and an early degree of a fibrotic capsule, the current study concluded that the infected bovine with liver abscess can cause much harm, affection in either health status and economic, by effecting the hematological and biochemical balance as well to the inflammatory changes related to this disease.

**Keywords:** Bovine liver abscess BLA, Biochemical, Hematology, Pathology.

### Introduction

The liver abscess is regarded as the most challenging issue for the feedlots industries [1]. Liver abscess a direct result of feeding practice; the diet is an important factor influencing the prevalence [2]. The occurrence of bovine liver abscesses (BLA) is a common problem in cattle that are resulted in feeding diets containing high fermentable carbohydrates, among other factors [3]. The prevalence of BLA has been ranged 12-32% in slaughtered animals but can be a low percentage from 1% to 2% to a high percentage of 90% to 95%, but averages 20% to 30% in most feedlot cattle in individual groups [4].

BLA was formed 45% of the causes of hepatic condemnations in slaughtered cattle in USA [5]. There are many factors, which appear to be associated with the condition including the level of feeding, age of the animal and particularly the quality aspects of the feed, which the cattle are offered [6]. BLA can result from a common bacterium, *F. necrophorum*, which inhabits rumen lesions caused by acidosis and subsequently escapes into the bloodstream, then filtered by the liver, and causes abscesses, the results of the recent National Beef Quality Audit in 2016 reported that the occurrence of BLA has increased [7]. The BLA is a source of economic losses for feedlot cattle [8]. It reduced the carcasses

weights, qualities, and values. These may be similar effectiveness for the control of liver abscesses in bovine [9]. Besides, in a recent report to the histopathological examination of BLA has been revealed the lesions were characterized by abscessation surrounded by the pyogenic membrane, besides, neutrophils infiltration and RBCs in the sinusoids surrounded by the pyogenic membrane consisting from the proliferation of fibrous connective tissue with neutrophils in the lumen of blood vessels; Also reported abscess with liquefactive necrosis showed in the center surrounded by a marked thickened pyogenic membrane [10]. BLA was considered an economic problem responsible for contaminating livers, that associated with fewer feed intakes, weight gains, and dressing percentages, they increase trimming and as consequence damage the profitability of feedlot producers and slaughter plant owners, BLA reduces feed intakes, weight gains, feed efficiencies, and dressing percentages so it was suggested that a relationship exists between the severity of BLA and animal performances [11].

The current study was aimed to examine bovine liver abscesses to identify the pathological aspects of the liver of slaughtered cattle at Basrah Abattoir.

### **Material and Methods**

The clinical examinations were done to a randomly 70 cows that conducted the Basra abattoir between the periods extend from August to December, 2019 ; In which 70 specimens of the bovine livers were performed according to veterinary ethics to obtain a small piece of liver tissue to diagnose BLA and assist in disease management. The livers from 70 cows were collected and thoroughly examined. Sixty of them showed gross lesions in all liver lobes while the other ten were normal in texture and morphology used as a control. All observed lesions were recorded and then the liver specimens can obtain tissue via cutting, which yielding intact tissue by scalpel [12]. The livers were examined macroscopically to study the lesions associated with liver abscess. The gross lesions were documented through imaging by a camera (digital canon). Subsequently, the wash of specimen with water for removal of the blood then placed it in a plastic container, which contains neutral buffered formalin 10%. The obtained specimens used for routine H&E Stain to distinguish anywhere of the pathological lesions in the liver, while the special stains as Gram stain used to distinguished the

bacterial presents in the liver lesions and Mallory trichrome stain used to distinguished the present of collagen deposition as an indicator for fibrosis, these special stains used for establishing a specific further diagnosis.

The blood samples were collected during the clinical examination of both BLA and healthy animals which done according to Abdelaal et al. [13] from the external jugular vein to perform complete blood cell (CBC) count and the serum separation for evaluation of AST, ALT, ALP, and LDH.

The data was analyzed and the significant difference between the liver abscess group and the healthy group was statistically analyzed using (SPSS) program.

### **Results**

There is a significant ( $P \leq 0.05$ ) increase in total WBCs counts, lymphocytes counts and neutrophils counts of BLA group, which showed ( $9.53 \pm 1.46$ ), ( $6.38 \pm 1.5$ ) and ( $1.98 \pm 0.36$ ) respectively when compared to the value ( $5.05 \pm 0.07$ ), ( $5.08 \pm 0.06$ ) and ( $1.01 \pm 0.04$ ) of the healthy group respectively (Table 1).

The results of the biochemical analysis showed significant ( $P \leq 0.05$ ) increase of BLA group of AST, ALT, ALP and lactate dehydrogenase (LDH) which showed ( $17.08 \pm 2.72$ ), ( $3.66 \pm 0.23$ ), ( $195 \pm 0.98$ ) and ( $1514.16 \pm 50.44$ ) respectively when compared to the healthy group, which showed ( $8.21 \pm 1.41$ ), ( $2.29 \pm 0.12$ ), ( $125 \pm 1.09$ ) and ( $343.33 \pm 21.53$ ) respectively (Table 1).

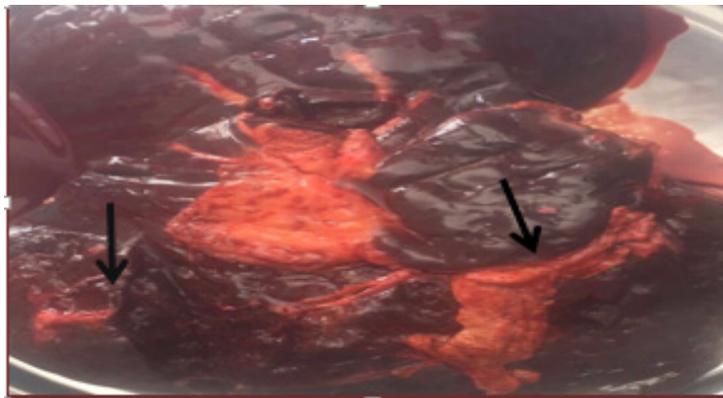
The BLA group showed multiples nodules vary in size which dispersed on the diaphragmatic and visceral surfaces either in a large or small abscesses, also, there is a marked area of congestion and the texture is firm; also, the surface of the liver in the affected group showed friable areas and multiple grayish-white abscesses that containing whitish cheesy material and surrounded by reddish hyperemic zone or pale yellowish area on the diaphragmatic surface of the right lobe. Also, there are multiple areas of abscesses visible grossly in the hepatic surface (Fig. 1). In other transverse sections, there are multiples abscesses areas in the hepatic parenchyma particularly in the subcapsular region (Fig. 2).

The histopathological result (H&E stain) revealed the abscess capsule showed severe infiltration of polymorphonuclear cells infiltration

**TABLE 1. The Hematological and biochemical results of BLA and control.**

Parameters	BLA group	Control group
Total WBCs Count ( $10^3/\mu\text{l}$ )	9.53±1.46 a	5.05±0.07 b
Lymphocytes count ( $10^3/\mu\text{l}$ )	6.38± 1.5 a	5.08± 0.06 b
Neutrophils count ( $10^3/\mu\text{l}$ )	1.98± 0.36 a	1.01± 0.04 b
AST (U/L)	17.08±2.72 a	8.21± 1.41 b
ALT (U/L)	3.66± 0.23 a	2.29± 0.12 b
ALP (U/L)	195± 0.98 a	125± 1.09 b
LDH (U/L)	1514.16±50.44 a	343.33± 21.53 b

\*Values are mean± standard error of mean\*( $P\leq 0.05$ ). \*Different letters vertically refer to present significant differences between group.



**Fig. 1.** Gross section in the liver of infected group, showed the surface was friable areas surrounded by reddish hyperemic zone on the diaphragmatic surface the right lobe (black arrows).

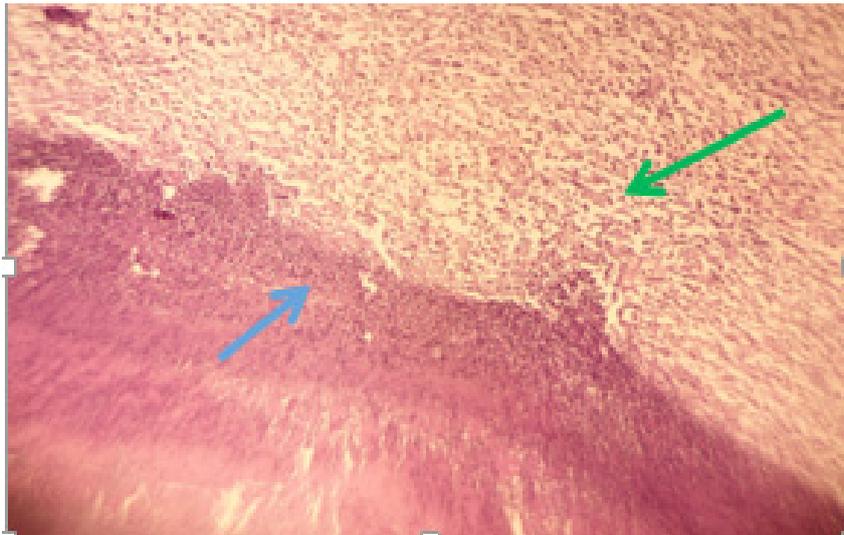


**Fig.2.** Transverse sections of the liver infected group showed there are multiples abscesses areas in the hepatic parenchyma particularly in the subcapsular region (black arrow).

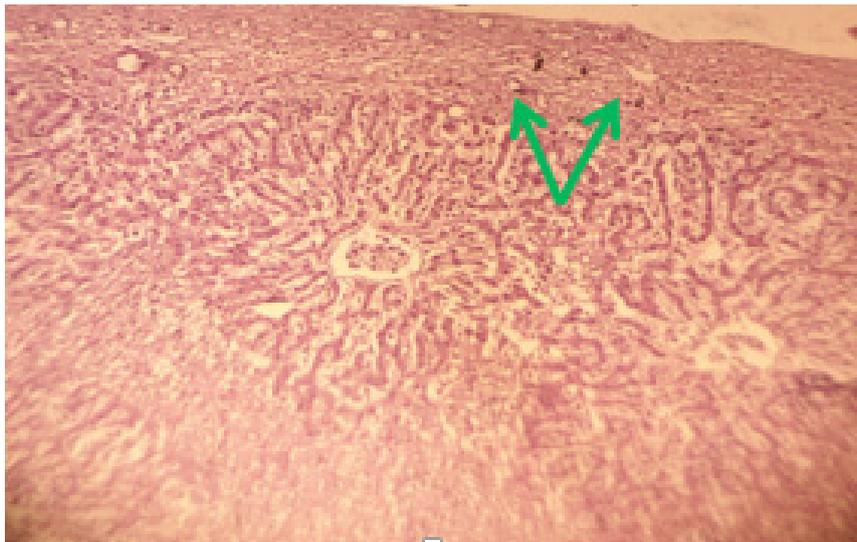
mainly neutrophils especially around the abscess capsules. In addition, there is a severe abscessation surrounded by inflammatory zone like capsule (Fig. 3). Besides, there is multiples areas of abscessations were found in the hepatic parenchyma particularly in the subcapsular region represented by focal infiltration of neutrophilic cellular (Fig. 4).

In another stain (Mallory trichrome stain) used to demonstrate the collagen fibers, the deep stained blue revealed the formation of bridging

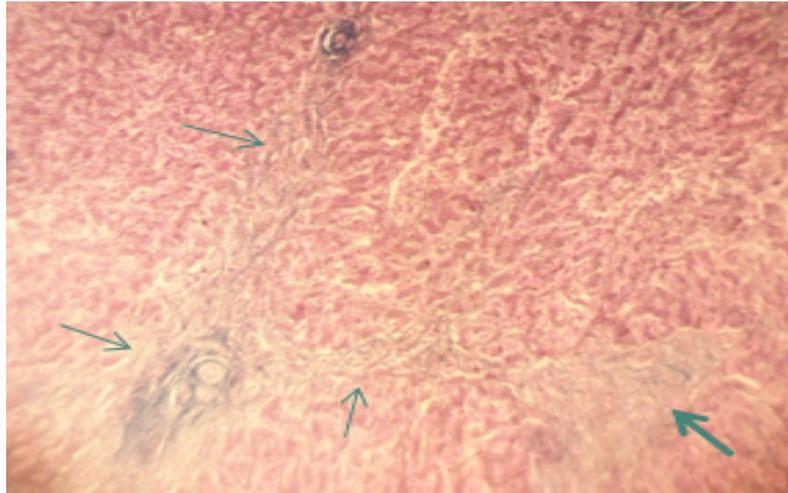
fibrosis which it considered the late stage of liver fibrosis that appeared in the late form of chronic liver diseases. The bridging means the formation of bands of mature to thickened fibrous tissue extends from the portal region to the central vein leads to the formation of pseudolobules (Fig. 5). In another stain (Gram stain) used for the demonstration of microorganisms in the tissue showed a density of gram-positive bacilli shape, with formation of abscesses distributed in many sections of the liver parenchyma (Fig.6).



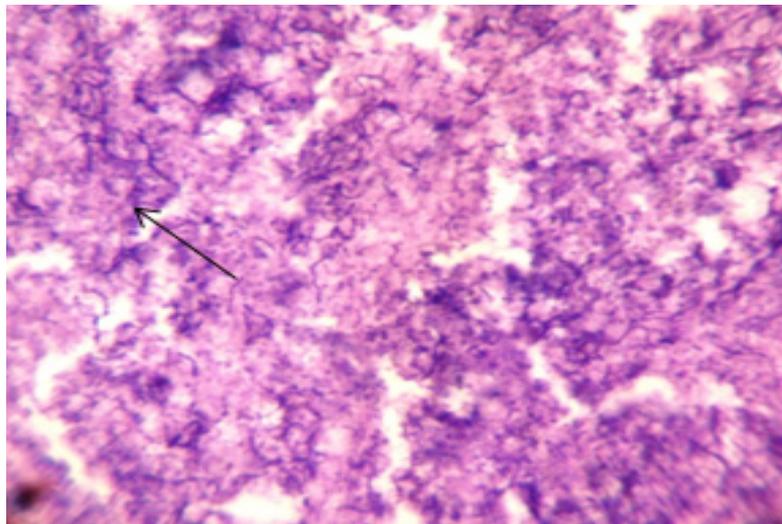
**Fig. 3.** Histopathological section of the liver of the BLA group, showed severe infiltration of polymorphonuclear cells infiltration mainly neutrophils around the abscess capsules (green arrow), also there is a severe abscessation surrounded by inflammatory zone like capsule (blue arrow) (H&E stain, 10X).



**Fig. 4.** Histopathological section of the liver of the BLA group, revealed to multiples abscesses areas were found in the hepatic parenchyma particularly in the subcapsular region represented by focal infiltration of neutrophilic cellular (green arrows) (H&E stain, 10X).



**Fig.5. Histochemical section of the liver of the BLA group showed the collagen fibers deposition stained deep blue leads to the formation bridging fibrosis (deep green arrows) (Mallory trichrome stain, 10X).**



**Fig. 6. Histochemical section of the liver of the BLA group showed it was a density of Gram-positive bacilli shape demonstrates with the formation of abscesses (black arrow). (Gram stain, 100X).**

## **Discussion**

The current hematological results of liver abscess animals showed that the stimulated immune state of animals might result in the significant increase in total WBCs in this study; these findings is in agreement with Dore et al.[14] who mention that the pyogenic liver abscess leads to increase total WBCs in the affected. Moreover, the result of lymphocyte count showed a significant increase in LA group that may due to the lymphocyte play an essential role in the progression of the liver abscess by secreting its inflammatory cytokines to modulate the abscess

formation; these findings are consistency with Zahorec [15] who mentioned that lymphocytes play an important role by undergoing apoptosis with various anti-inflammatory cytokines. Besides, the current results showed a significant increase in the neutrophil level count of LA group in blood and tissues in acute bacterial infections; These may due to the neutrophil responsible for the killing of pyogenic bacteria that causing liver abscess; These ideas with agreement to Gregory et al.[16] who reported that the immigrating neutrophils play a role in killing bacteria trapped in the liver as well to neutrophils contribute to the pathogenesis of this disease. Also, the current

hematological results were in agreement with a recent study reported that elevated white blood cell (WBC) count and increased percentage of neutrophils in the liver abscess patients [17].

The biochemical analysis was a very helpful tool to evaluate the health status of the animals, in this study we measured the levels of liver function enzymes to evaluate the harmful effect of liver abscess in the studied animals; Therefore, The current biochemical results showed a significant increase of AST, ALT, ALP and lactate dehydrogenase (LDH) in the BLA group compared to control, these may as a results to serious injury to the hepatocytes due to pathogens that causing liver abscess causing damage to the hepatic tissue resulted to increase of liver enzymes; These results may agree with [18] who revealed a highly significant increase in serum AST, ALT and ALP of liver abscess cases compared to healthy. Beside elevation of serum lactate dehydrogenase (LDH), these results may agree with [19] who reported in patients *F. necrophorum* was isolated from oral smears, liver aspirates, and blood samples; Also, they mentioned the BLA caused by periodontal infection was rarely reported; However, the incidence of periodontitis is extremely common and is on the rise as one of the most common chronic infections worldwide.

The current study results of BLA showed there were multiple nodules varies in size which dispersed on the diaphragmatic and visceral surfaces either a large abscess or small abscess; Besides, there is a marked area of congestion and the texture is firm, Also, the surface of the Liver in the affected group showed friable areas and multiple grayish-white abscesses that containing whitish cheesy material and surrounded by reddish hyperemic zone or pale yellowish area on the diaphragmatic surface of the right lobe; The above-mentioned results were in agreement with Tehrani et al.[20] who reported many lesions in cows and other animals that affected with liver abscess. The current macroscopical results were in the same line with our hematological and biochemical results were showed an increase in total WBCs as well to lymphocytes and neutrophils which indicated that the nodules showed in gross section resulted from aggregation and/or severe infiltration of inflammatory cells in the different parts of the liver causing abscesses due to pathogenic agent stimulation.

In other transverse sections, there are multiples abscesses areas in the hepatic parenchyma

particularly in the subcapsular region; Besides, there are multiple areas of abscesses visible grossly in the hepatic surface; Our results agreed with Aliasghar et al.[21] who reported that the hepatic abscesses were filled with pus which contains a purulent yellowish-green or white, yellow and mucous materials and it has capsules that differ in it thickness, and size.

It was noticed the area of early fibrosis surrounding the central vein region, as well as the proliferation of kupffer cells. The portal vein showed dilation as well to mononuclear leukocyte infiltration and congestion of the hepatic sinusoids, in addition to high proliferation and hyperplasia of the epithelial cells of the bile ducts and hepatic artery followed by fibrous capsule infiltrated with leucocytes. These results was followed those obtained previously [22] who are isolated tuberculous liver parenchymal and sub-capsular abscesses. In the present study, the abscess capsule showed severe infiltration of polymorphonuclear cells infiltration mainly neutrophils especially around the abscess capsules; Also there was a severe abscessation surrounded by inflammatory zone like a capsule. In other sections, the histopathological changes showed severe periportal area necrosis; Also, there was a dilation of the portal vein, with periportal area infiltration of inflammatory cells. The portal vein showed dilated cystic like projection and filled with infiltration of inflammatory cells as well to inflammatory exudate, besides, there was the infiltration of inflammatory cells around of portal vein and an early degree from fibrosis capsule. This result was similar to what described previously [13] who documented that BLA varied from a hypoechoic to a hyperechogenic with or without a capsule.

The histochemical studies were good diagnostic tools for evaluation of the many hidden aspects of inflammation and repair; therefore, the current study used several special stains to estimate the role of the tissue against the invaders and the pathological changes. (Mallory trichrome stain) used to demonstrate the collagen fiber deposition showed periportal trait deposition of collagen revealed to fibrosis which stained deep blue are markedly increased around the portal vein and the hepatic artery. Moreover, it showed prolong – parallel deposition of the collagen fibers stained deep blue are markedly increased around the abscess capsule revealed to fibrosis. Similar findings were described by Morinaga et al.[23],

where users of the Mallory stain to estimate the degree of liver fibrosis. In another stain (Gram stain) used for demonstration of microorganisms in the tissue which showed a density of Gram-positive bacilli shape demonstrates the formation of abscesses distributed in many sections of liver parenchyma. These results agree with the previous findings of Dutta et al.[24] who mentioned that gram's stain was very helpful to distinguish and reveal gram-negative and positive large rods morphologically indistinguishable. Moreover, the liver abscess is a pus collecting area it may amoebic or pyogenic, and rarely tubercular or fungal in origin [25]. The current study concluded that the infected bovine with liver abscess can cause much harm, affection in either health status and economic, by effecting the hematological and biochemical balance as well to the inflammatory changes related to this disease.

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### *Ethical consideration*

This study was carried out in accordance to the ethical rules for samples handling and animal's managements and researches, College of Veterinary Medicine, University of Basrah, Ministry of Higher Education and Scientific Researches, Republic of Iraq.

### *Conflicts of interest*

The authors declare no conflict of interests of the manuscript.

### *Funds statement*

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## التقييم المرضي لخراجات الكبد في الابقار في مجزرة محافظة البصرة، العراق

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تهدف الدراسة الحالية الى التقييم المرضي لخراجات الكبد في الابقار في مجزرة محافظة البصرة، لذلك تم جمع ٧٠ عينة كبد أظهرت ٦٠ عينة منها افات خراجية بينما استخدمت ١٠ عينات لأكباد سليمة من ابقار سليمة كمجموعة سيطرة. أظهرت النتائج الدمية وجود ارتفاع معنوي في مستويات كريات الدم البيضاء الكلية و الخلايا للمفاوية والخلايا العدلة مقارنة مع فحوصات مجموعة السيطرة، كذلك أظهرت نتائج الفحص الكيميائي الحيوي وجود زيادة معنوية في قيم انزيمات الكبد AST و ALT و ALP و LDH لدى الابقار المصابة بخراجات الكبد مقارنة مع فحوصات الابقار السليمة.

أظهرت نتائج الفحص المرضي العياني لأكباد الابقار المصابة بالخراجات وجود عقيدات متعددة الاشكال والاحجام منتشرة على السطح الحجابي والحشوي للكبد حيث كانت هشّة القوام ذات لون رصاصي مائل للبياض وقد احتوت على مواد متجينة بيضاء اللون.

بينما أظهرت نتائج الفحص المرضي النسيجي المجهرى وجود توسع في الوريد المركزي الكبدي مع ارتشاح الخلايا الالتهابية متعددة النوية وكذلك تم ملاحظة مناطق من التفجى الخلوي في الخلايا الكبدية المحيطة للوريد المركزي، كذلك شوهد ارتشاح شديد للخلايا الالتهابية لمنطقة تحت محفظة الكبد، اما المنطقة البابية الكبدية فأظهرت توسع شبيه بالكيسي مملوء بالخلايا الالتهابية مخلوط بالنضحة الالتهابية، من ناحية أخرى تم ملاحظة ارتشاح شديد للخلايا الالتهابية حول منطقة الوريد البابي الكبدي مع وجود تليف.

استنتجت الدراسة الحالية ان الخراجات الكبدية قد سببت تأثير كبير على صحة الابقار وسلامتها ونتاجيتها كذلك لهذه الخراجات تأثير كبير على التوازن الدمى الكيميائي الحيوي من خلال التغيرات المرضية والالتهابية المرافقة لهذه الافات المرضية.