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A Clinical Association of Dry Socket and Postoperative Pain with Typhoid fever as Risk Factor

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الخلاصة

الأهداف: تهدف الدراسة الى تحديد الصورة السريرية، والارتباط بين مأخذ الجافة وتطور شدة ما بعد الجراحة مع واحدة من عوامل المخاطر النظامية (حمى التيفوئيد). **المواد وطرق البحث**: تمت دراسة (عشرون من المرضى الكبار (ومن كلا الجنسين) من مراجعون لعيادة طب الأسنان بحثا عن علاجات الأسنان المختلفة. تم تقييم الصورة السريرية لدراسة 6 أشهر من خلال استكمال شكلين من أوراق الحالة. وقد تم تشخيص وجود مآخذ الجافة وألم ما بعد الجراحة الحاد. مع أخذ عينات الدم للدراسات البكتريولوجية، المصلية لتشخيص حمى التيفوئيد. وشملت هذه الاختبارات فحص الويدال، فحص تفصيل الويدال ، عدد الكريات البيضاء وزرع الدم. **النتائج**: أظهرت النتائج وجود علاقة ملحوظة بين الم ما بعد العملية وحمى التيفوئيد مقاسه بواسطة زرع الدم وان أعلى نسبة كانت مع مأخذ الجافة (٪61.5) تبعها فحص تفصيل الويدال (٪ 57.1) و فحص الويدال (44،4 ٪) وباستخدام اختبارين للتشخيص اظهر فحصي تفصيل الويدال وزرع الدم (٪ 97.9) موجبة مع مأخذ الجافة وان ارتباط الكابا كان (٪88) ، في حين اظهر فحصي الويدال و عدد الكريات البيضاء أو فحصي الويدال وتفصيل الويدال أعطى أقل ارتباط معنوي. **الاستنتاج**: هناك ارتباط قوي بين مأخذ الجافة وحمى التيفوئيد والاختبارات الأكثر حساسية للتشخيص كانت زرع الدم متبوعا بتفصيل الويدال ، عدد الكريات البيضاء و الويدال.

ABSTRACT

Aims: To identify the clinical picture and the association between dry socket and severe postoperative development with one of the systemic risk factors (typhoid fever). **Materials and Methods:** Twenty adult (both sexes) patients attended dental clinic searching for different dental treatments were studied. The clinical picture of 6 months period study was evaluated by completing two case sheet forms. They were diagnosed having dry sockets and severe postoperative pain. Blood samples were taken for bacteriological, serological and hematological study to diagnose typhoid fever. These tests included WAT, WFT, WBCs and blood culture. **Results:** Significant correlation existed between postoperative pain and typhoid fever examined by BC and the highest percentage was with dry socket (61.5%) followed by WFT (57.1%(, WAT (44.4%) using two tests for diagnosis showed that WFT and BC gave 97.9% positive for dry socket and Kappa test was 88%, while WAT and WBCs or WFT and WAT gave the least non significant correlation. **Conclusion:** There was a strong correlation between dry socket and typhoid fever and the most sensitive tests for diagnosis was BC followed by WFT, WBCs and WAT.

Keywords: Typhoid fever, dry socket, postoperative pain

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INTRODUCTION

Dry socket is one of the most common complications of tooth extraction and is characterized by severe pain starting usually on the 2nd or 3rd day postoperatively.[1] Its prevalence has been reported to vary from 5–35%,[2] and is more common following mandibular 3rd molar extraction.[3, 4] The exact pathogenesis of dry socket is not well understood. However, disintegration of blood clot by fibrinolysis remains the most widely accepted theory.[5] Several contributing factors have been reported to be associated with an increase risk of dry socket. They include traumatic extraction,[1, 5] site of extraction,[3, 6] use of local anesthesia with no vasoconstrictors,[7] inadequate postoperative irrigation[8] and postoperative infection.[5, 9]

The cause of dry socket with postoperative pain has always been suspected that normal healing process is disrupted and delayed, thus leading to the loss or lack of proper formation of a normal blood clot.[10] Among one of these bacterial infections is typhoid fever, which is caused by *Salmonella typhi*.[11] In developing nations where

typhoid fever is endemic, most cases result from contaminated drinking water and poor sanitation. Therefore, it remains a serious threat in the developing world especially those with hot climate.[12] Nearly one third of people with typhoid fever develops complications such as osteomyelitis.[11]

The current work was conducted to study the association between post–extraction complications such as dry socket and severe post–extraction pain with typhoid fever.

MATERIALS AND METHODS

Data Collection

The dentist has observed accidentally that patients suffering from typhoid fever complain of dry socket with severe sharp postoperative pain. Record information was taken from each patient who included medical history, medication, chief complaint, teeth extracted, indication for extraction, amount and technique of local anesthesia and postoperative medications.

A second special form of information was completed for each patient who came back to the clinic during the study period and was diagnosed having dry socket for the referral to a specialist in bacteriology to confirm diagnosis of typhoid fever. This form included items such as signs and symptoms, onset of symptoms and treatment.

Study Group

Patients were divided into four categories as follow:

I: Patients complaining of acute pulpitis, chronic pulpitis, partially impacted lower and upper 3rd molar (seeking extraction).

II: Patients seeking scaling and polishing (periodontal treatment).

III: Patients with maxillary sinusitis pain.

IV: Patients with operative problems (pontic bridge).

Diagnosis of Typhoid Fever

- *Serological Tests:*

1. Widal Agglutination Test (WAT)

The test is based on agglutination made by bacterial antigen with patient serum using Widal kit (Plasmatec Laboratory Products Ltd, UK). Such agglutination could be seen by naked eyes; 50 ml of antigen suspension added to 50 ml of two fold serum dilutions, mixed and read within two minutes at 25°C. The highest dilution that gives positive agglutination is regarded as the titer.

2. Widal Fractionation Test (WFT)

The test is based on the ability of 2–mercaptoethanol to break down IgM antibodies when mixed at 37°C for one hour.[13] Therefore, it is easy to differentiate between acute (recent) and chronic (past) infections.

- *Hematological Tests:*

1. White Blood Cells Count (WBCs)

Twenty milliliters of blood was mixed with 0.4 ml of WBCs solution for 10 minutes and 0.01 ml was added to WBCs chamber and WBCs were counted.[14]

2. Blood Culture (BC)

Five milliliters of blood was directly inoculated into 10 ml of Brain Heart Infusion broth (Oxoid Ltd., England) and incubated at 37 °C for 5–7 days in the presence of 5% CO_2.[15] After day 7, a drop of positive blood culture was inoculated on Blood and MacConkey agars (Oxoid Ltd., England) and incubated at 37 °C for 3 days.

- Biochemical Test

Positive cultures on Blood and MacConkey agars were identified biochemically using API test.

Data Analysis

Data were analyzed using t–test, Fisher Freeman–Helman test, Duncan's Multiple Range analysis and Kappa test.

RESULTS

Patients were divided into four categories according to postoperative pain:

SP: Sinusitis pain.

DS: Dry socket pain.

JP: Joint pain.

JPF: Joint pain of face.

Significant relationship between the four categories of postoperative pain and BC was noticed (Table 1). The highest percentage of positive BC was in DS (61.5%), while the highest negative BC was seen in JPF (71.4%).

Table (1): Association of postoperative pain categories patients and blood culture

Postoperative Pain Categories	Positive BC		Negative BC		*p*–value
	No.	%	No.	%	
SP	0	0.0	2	28.6	<0.001
DS	8	61.5	0	0.0	
JP	3	23.1	0	0.0	
JPF	2	15.4	5	71.4	
Total	13	100.0	7	100.0	

BC: Blood culture; SP: Sinusitis pain; DS: Dry socket pain; JP: Joint pain; JPF: Joint pain of face.

Also significant relationship between the four group categories and WFT (Table 2). The highest percentage of positive WFT was noticed in DS (57.1%) and the highest percentage of negative WFT was seen in JPF (83.3%).

Table (2): Association of postoperative pain categories patients and WFT

Postoperative Pain Categories	Positive WFT		Negative WFT		*p*–value
	No.	%	No.	%	
SP	1	7.1	1	16.7	0.0011
DS	8	57.1	0	0.0	
JP	3	21.4	0	0.0	
JPF	2	14.3	5	83.3	
Total	14	100.0	6	100.0	

WFT: Widal Fractionation Test; SP: Sinusitis pain; DS: Dry socket pain; JP: Joint pain; JPF: Joint pain of face.

The results of different tests used for diagnosis of typhoid fever are shown in Figure (1). It is clear that all patients were positive with WAT, while only 70% were positive with WFT and in WBCs 65% and in BC 50%.

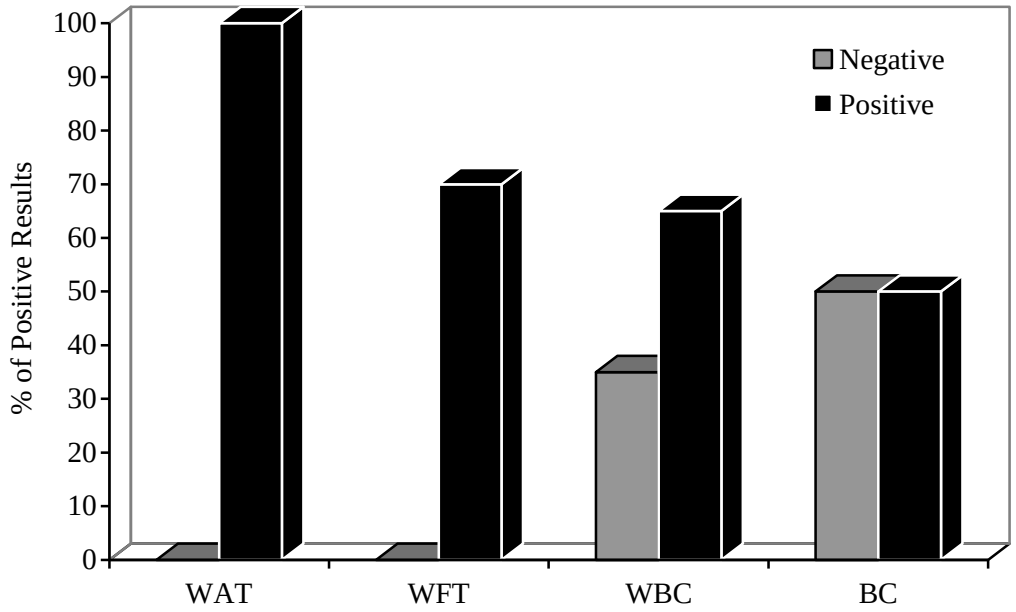

Figure (1): Percentage of positive results according to different tests used for the diagnosis of typhoid fever

WAT: Widal Agglutination Test; WFT: Widal Fractionation Test; WBC: White Blood Cell

count; BC: Blood culture.

Applying these positive results to the incidence of DS, BC showed 61.5% positive, while WFT (57.1%), WAT (44.4%) and WBCs (20%) as shown in Figure (2).

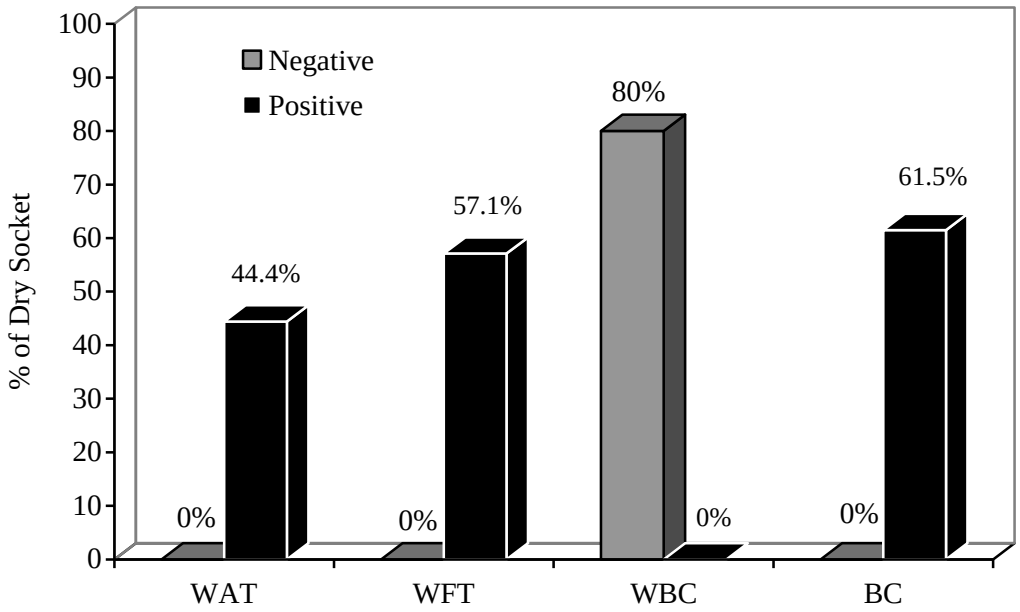

Figure (2): Percentage of dry socket according to WAT, WFT BC and WBC results

WAT: Widal Agglutination Test; WFT: Widal Fractionation Test; WBC: White Blood Cell count; BC: Blood culture.

Statistically, there were significant differences between positive and negative different bacteriological tests: WAT and BC at $p < 0.02$, BC and WBCs at $p < 0.001$ and WAT and WFT at $p < 0.012$, as it is clearly shown in Table (3).

Table (3): Significant values of typhoid patients between positive and negative different bacteriological tests

	Mean ± SE		
	Positive BC (n= 13)	**Negative BC (n= 7)**	***p*–value**
Typhoid	356.92 ± 133.1	205.71 ± 111.8	0.02
WBC	2784.62 ± 415.32	4242.86 ± 359.9	<0.001
	WFT (n= 14)	**WFT (n= 6)**	***p*–value**
Typhoid	354.29 ± 128.3	186.67 ± 109.3	0.012

BC: Blood culture; WFT: Widal Fractionation Test; WBC: White Blood Cell count.

A comparison of typhoid patients diagnosed by WAT with other tests, it was clear that WAT showed 70% positive results with WFT, while 50% by WBCs test and BC test (65%) as it is shown in Table (4).

Association of different bacteriological tests used for the diagnosis of typhoid fever is clearly shown in Table (5). There was significant association between WFT and WBCs positive results (71.4%), Kappa test showed 60% association. Also, there was significant association between WFT and BC positive results (92,9%), Kappa test

showed 88.6% association. Significant association between WBCs and BC (76.9%) of patients and Kappa test showed 70% association.

All negative results in all tests were 100% coincided. The association between WFT and BC gave the highest percentage (88%), followed by WBCs and BC (70%) and WFT and WBCs (60%), respectively.

Table (4): Typhoid patients diagnosed by WAT comparison with different bacteriological tests (WFT, WBC, BC)

	Positive WAT		**Negative WAT**		***p*–value**
	No.	**%**	**No.**	**%**	
Positive WFT	14	70.0	0	0.0	
Negative WFT	6	30.0	0	0.0	
Total	20	100.0	0	0.0	
Positive WBC	10	50.0	0	0.0	
Negative WBC	10	50.0	0	0.0	
Total	20	100.0	0	0.0	
Positive BC	13	65.0	0	0.0	
Negative BC	7	35.0	0	0.0	
Total	20	100.0	0	0.0	

WAT: Widal Agglutination Test; WFT: Widal Fractionation Test; WBC: White Blood Cell count; BC: Blood culture.

Table (5): Association of different bacteriological tests used for diagnosis of typhoid fever

	Positive WFT		**Negative WFT**		***p*–value**
	No.	**%**	**No.**	**%**	
Positive WBC	10	71.4	0	0.0	0.011
Negative WBC	4	28.6	6	100.0	
Total	14	100.0	6	100.0	
Measure agreement Kappa test= 0.600					
Positive BC	13	92.9	0	0.0	<0.001
Negative BC	1	7.1	6	100.0	
Total	14	100.0	6	100.0	
Measure agreement Kappa test= 0.886					
	Positive BC		**Negative BC**		***p*–value**
Positive WBC	10	76.9	0	0.0	0.003
Negative WBC	3	23.1	7	100.0	
Total	13	100.0	7	100.0	
Measure agreement Kappa test= 0.700					

WFT: Widal Fractionation Test; WBC: White Blood Cell count; BC: Blood culture.

DISCUSSION

Dry socket with severe sharp post-operative pain and sinusitis pain frustrate dentists since treatment is always symptomatic consisting of trying to control the pain which can last up to a week.[1] These conditions were observed accidentally by the dentist when patients returned for postoperative visit and diagnosed as dry socket, although the extraction procedures, operative management, scaling and polishing were performed under sterile conditions with sterile instruments and adequate local anaesthesia at the work site. After thorough dental examination with thorough medical examination (clinically by examining fever, sinusitis, knee joint pain) which gave the impression of having systemic bacterial disease. These conditions are characterized by sharp severe conti-

nuous postoperative pain that couldn't be relieved by moderate pain inhibitors. Therefore, WAT was carried out on the sera of such conditions.

Several results have been advocated to reduce the incidence of dry socket including the use of antiseptic mouth wash,[8, 16] antifibrinolytic agents, antibiotics, steroids,[17] clot supporting agent[10] and after intraalveolar dressings and medications.[4, 18]

The generally accepted etiology of this condition is an increase local fibrinolysis leading to disintegration of the clot, thereby decreasing the incidence of dry socket which leads to liberation of different tissue activators and bacterial infections remain the most acceptable initiating factor of this localized fibrinolytic activity.[19]

Different studies suggested relationship between dry socket and some systemic diseases.[3, 5, 20] In this study we noticed that dry socket patients showed positive result for typhoid fever, therefore further tests were introduced for accurate diagnosis and to make some sort of comparison between different tests. Significant correlation existed between the four categories of postoperative pain and BC. The highest percentage was with dry socket (61.5%) followed by WFT (57.1%) and WAT (44.4%).

It was also clear that the WAT gave false positive in relation to dry socket which was confirmed by WFT and BC. All groups of patients showed positive WAT with different titers. This gave an indication that WAT was not specific test especially in an endemic area as well as cross reactivity with other infections.[21,22] This explanation was true when WFT was used to differentiate between recent and post typhoid infections and showed 57% positive with dry socket.

Typhoid is well known to cause leukopenia,[14] which can help as a tool for typhoid diagnosis as it gave 60% positive results. However, WBCs can not be used alone for typhoid fever diagnosis as many diseases cause leukopenia.

Blood culture is the most specific and gives definitive diagnosis of typhoid fever. It showed 61.5% of dry socket, but it is time consuming. Statistically, the most accurate tests in this study were WFT combined with BC (92.9%) positive results of dry socket and Kappa test was 88%. The least non significant tests were WAT combined with WBCs and WFT and WBC.

The mechanism by which typhoid fever induced dry socket is not known. It may be associated with osteomyelitis caused by typhoid fever,[11] which may facilitate dry socket. Further investigations are in progress.

CONCLUSION

There was a significant correlation between dry socket and typhoid fever and the most sensitive test for typhoid diagnosis was BC followed by WFT, WBC and WAT.

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