

1961

## Role of dental sepsis in postoperative surgical complications

John Edward O'Connor  
*University of Nebraska Medical Center*

This manuscript is historical in nature and may not reflect current medical research and practice. Search [PubMed](#) for current research.

Follow this and additional works at: <https://digitalcommons.unmc.edu/mdtheses>

---

### Recommended Citation

O'Connor, John Edward, "Role of dental sepsis in postoperative surgical complications" (1961). *MD Theses*. 2564.

<https://digitalcommons.unmc.edu/mdtheses/2564>

This Thesis is brought to you for free and open access by the Special Collections at DigitalCommons@UNMC. It has been accepted for inclusion in MD Theses by an authorized administrator of DigitalCommons@UNMC. For more information, please contact [digitalcommons@unmc.edu](mailto:digitalcommons@unmc.edu).

**THE ROLE OF DENTAL SEPSIS IN POST-OPERATIVE SURGICAL COMPLICATIONS**

**John E. O'Connor**

**Submitted in Partial Fulfillment for the Degree of  
Doctor of Medicine**

**College of Medicine, University of Nebraska**

**April 1, 1961**

**Omaha, Nebraska**

## TABLE OF CONTENTS

	Page
I. Introduction . . . . .	1
II. Materials and Methods . . . . .	1
III. Discussion of Results . . . . .	6
IV. Review of Literature . . . . .	9
V. Conclusions . . . . .	13
VI. Summary . . . . .	15
VII. Results Tabulated . . . . .	16
VIII. Acknowledgments . . . . .	20
IX. Bibliography	

## INTRODUCTION

We must make every effort to increase the safety of major operations. As a dentist in medical school, I was interested to see the dental conditions in the patient before operation. This prompted the following investigation. In this study our interest is focused on the part dental infections may play in the post operative period. The results suggest that patients with dental infections have more complications after operations than those without dental infections. This study correlates with earlier findings of Nesselbush (Senior thesis, University of Nebraska College of Medicine, 1958) on a similar study of 80 patients.

## MATERIALS AND METHODS

We surveyed patients admitted on the surgical service of University Hospital for the presence or absence of dental infection by the following examinations.

1. Complete mouth dental X-rays.
2. Oral examination.

Dental sepsis was considered present if any one of the following conditions was found present in the patient's mouth.

1. Dentoalveolar abscess - an accumulation of inflammatory cells at the apex of a tooth. There is usually a resorption of the lamina dura. A great deal of bone may be involved

as the lesion expands peripherally with concomitant bone destruction.

2. Dental granuloma - a form of chronic dentoalveolar abscess. A fibrous sac continuous with the periodontal membrane often surrounds this lesion. The fibrous capsule encloses the infected tissue and projects into the adjacent bone. The apex of the tooth itself is generally denuded and is in direct contact with the granulation tissue. There may be necrosis in the center of the lesion.

3. Dental cyst - results from dissolution of the central part of a granuloma. The pressure exerted by the cystic fluid causes pressure on the cystic wall and subsequent enlargement of the cystic cavity in the bone. There is usually a compact layer of bone around the cyst.

4. Gingivitis - an inflammatory condition of the gingivae occurring in both acute and chronic forms. The gingivae are edematous, red, and have a tendency to bleed very easily. The condition may be present throughout the mouth or it may be confined to certain areas.

5. Periodontitis - an inflammation of the marginal periodontium with resorption of the crest of the alveolar bone. The tissues affected are the gingivae, crest of the alveolar bone, and the portion of the periodontal membrane adjacent to the alveolar crest. One of the first signs of the disease is a loss of uniform coloration and a thickening of the gingival margin due

to the inflammation. Large quantities of calculus are frequently observed and a purulent exudate may be found in some instances. The gingivae are soft and spongy, bleed easily and gingival recession may be present.

6. Periodontosis - a non-inflammatory disease affecting the attachment structures of the tooth, namely: cementum, periodontal membrane, and alveolar bone. Mobility may be the initial sign in periodontosis and is attributed to a breakdown of the periodontal fibers and a proliferation of the capillaries. There is a simultaneous resorption of alveolar bone with proliferation and progression of the epithelium apically to form what is commonly referred to as a "pocket."

7. Periodontal abscess - an accumulation of inflammatory cells in the "pockets" or between the roots of multi-rooted teeth. Since these occur in teeth with normal pulps they are differentiated from dentoalveolar abscess. Sometimes the lack of drainage causes fistula formation.

8. Pericoronitis - an inflammation of the gingiva most frequently found surrounding partially erupted third molars. The condition may be aggravated by trauma when the inflamed gingiva over the tooth comes in contact with the tooth in the opposing jaw.

9. Residual infection - infection remaining after the extraction of a diseased tooth. Most often such infections

are due to the retention of a root fragment. There may be fistula formation with discharge of purulent material.

10. Impacted teeth - an impeded eruption of a tooth, most commonly present with third molars. This may be due to malposition, underdevelopment of the jaws, or obstruction by the ramus of the mandible or another tooth, when this tooth is in communication with the oral cavity.

If none of the above were found, no dental sepsis was considered present. Dental caries without periapical involvement was not considered as a focus of infection.

Each patient had a complete physical examination pre-operatively. We excluded from the study:

1. Patients with other foci present.
2. Patients with other pre-operative infections.
3. Patients with incisional biopsys.

Of the patients examined, 166 ultimately had a major operation. After the operative procedure and dismissal, I reviewed the patient's chart with reference to the post-operative temperature sheet and the resident's or staff member's notations. The following were noted:

1. Number of days post-operatively, if any, that the patient's temperature returned to below 100° F.
2. Respiratory infection.
3. Wound infection.

#### **4. Urinary tract infection.**

If any of the above were found to be present, it was considered a complication. Some patients had more than one of the above complications. Patients who qualified for the study were classified:

- 1. Dental sepsis**
  - a. with**
  - b. without**
- 2. Anesthetic agent**
  - a. general**
  - b. local or spinal**



## DISCUSSION OF RESULTS

As shown in Table #1, 123 patients out of the total of 166 had dental infections. The patients with dental sepsis had about twice as many complications as those without dental sepsis.

Table #2 compares the 123 patients in the group with dental sepsis to the 43 patients without dental sepsis. This is about a 3 to 1 ratio with the number of patients with dental sepsis being greater.

Of the patients with dental sepsis, 80% had complications whereas those without dental sepsis had complications in only 50%. This is statistically significant beyond the .05% level (Using the  $\text{Chi}^2$  test).

In the group of patients with dental sepsis, 76% had increased post-operative temperature over 100° F., whereas in the group of patients without dental sepsis, only 37% had increased post-operative temperature of over 100° F. This is also statistically significant beyond the .05% level ( $\text{Chi}^2$ ). More patients with dental sepsis had wound infections and urinary infections, but not to a statistically significant amount. Respiratory infections were equally common when no differentiation was made as to the type of anesthesia.

Table #3 compares the patients with dental sepsis to those without dental sepsis as to the type of anesthetic used. It is very interesting to note that 44 of the 78 patients with dental

sepsis and general anesthesia had post-operative temperatures above 100°F on the fourth or more post-operative days. This is more than 56% of the patients in the dental sepsis group. Only 2 of the 32 patients without dental sepsis having a general anesthetic had post-operative temperature above 100° F. on the fourth or more post-operative days. This is about 6%. This is statistically significant beyond the .01% level ( $\text{Chi}^2$ ).

In the dental sepsis group, the number of patients with post-operative temperature above 100° F. increases as the number of post-operative days increase. The reverse is true of those patients without dental sepsis.

Fourteen of the 110 patients with general anesthesia had respiratory infections as a complication; however, only one of the 56 patients with spinal or local anesthesia had respiratory infection as a complication.

Wound, urinary, and respiratory infections are increased in patients with dental sepsis over those without dental sepsis in the general anesthetic group, but the increase is not statistically significant ( $\text{Chi}^2$ ).

Wound and urinary infections are increased in patients with dental sepsis as compared to those without dental sepsis in the local or spinal anesthetic group.

As shown in Table #4, 18 cases of a single operation, cholecystectomy, were done under general anesthesia. The most

significant finding of this small group of patients is that 5 of the 11 patients with dental sepsis had a fever over 100° F. on the fifth or more post-operative day. None of the 7 patients without dental sepsis had a post-operative temperature above 100° F. beyond the third post-operative day. This is statistically significant beyond the .05% level.

Fever, the most frequent complication found post-operatively, was more frequent in patients with oral sepsis. I cannot explain the cause of the fever when it was the only complication. It may have resulted from subclinical infections from the respiratory tract, urinary tract, or wound infections.

## REVIEW OF LITERATURE

Focal infection is defined as a localized infection in the tonsils, tooth sockets or elsewhere, from which the microorganisms or their toxins are from time to time carried to other regions to produce local or general systemic infections. This theory was at its height in 1910-1930, with the work of Rosenow (1) and others. Since that time the theory has waned. No articles on the ability of dental sepsis to cause any post-operative surgical complications were found in a review of the literature. If oral sepsis can cause post-operative complications, then how?

Mitchell and Hellman (2) review the routes by which bacteria may spread from periodontal pockets surrounding the teeth. These routes are:

- A. Through the lymphatic and venous channels of the area.
- B. Along the mucous membrane, i.e. gastro-intestinal or pulmonary tracts through swallowing or aspiration of infective material.
- C. By direct extension within the tissues.

Lymphatic and venous spread. Oral infection can cause bacteremia (2, 3, 4). With bacteremia, there is a predilection for bacteria to be involved in the surgical site or in any other injured site. Menkin states (5): "It is well known that bacteria often float in the blood from which they are eliminated by various

bactericidal substances. When a traumatic or other kind of injury occurs, such bacteria may localize in injured areas where they accentuate the inflammatory process. This is often referred to by pathologists and clinicians as a locus minoris resistentia. It has been shown that bacteria introduced into the circulation accumulate in an inflamed area. It may, therefore, be that a so-called locus minoris resistentia can be explained in terms of increased capillary permeability in an area of injury followed by localization of various bacteria from the circulation."

Burke and Knighton (6) found, when they gave rats *S. aureus* intravenously, that the bacteria were localized in previously injured tissues.

Surface spread. Bacteria from oral infections may extend along mucous membrane to the trachea, bronchi, and lungs.

Belsey (7) quotes Dr. John Alexander, Ann Arbor, Michigan, a thoracic surgeon, as stating quite categorically that no edentulous patient ever developed a non-malignant lung abscess. Belsey further states: "There is still no justification for complacency" (with reference to oral disease). "The association of pulmonary suppuration and dental sepsis occurs sufficiently frequently to demand careful study and consideration." Belsey continues to consider that four distinct types of problems are involved:

1. Pulmonary suppuration occurring spontaneously in people with dental sepsis.

2. Pulmonary suppuration following general anesthesia in patients with dental sepsis.

3. Septic complications of thoracic operations in the presence of dental sepsis.

4. Pulmonary suppuration following dental operations.

He states that the lines of defence for surface spread of the infections are:

1. Larynx and laryngeal reflexes.

2. Cough reflex.

3. Ciliated epithelium of the bronchial mucosa.

Borrie and Donaldson (8) report two cases of lung abscess which they associate with dental sepsis.

J. B. McDonald (9) and co-workers state that *B. melanionogenicus* is a regular inhabitant of the mouth and is increased in number with periodontal disease.

Weiss (10) states that *B. melaninogenicus* (a common inhabitant of the oral cavity) was isolated with other aerobic and anaerobic bacteria from 45 surgical cases representing various infected wounds, lesions of pleura, and peritoneum as well as the gastro-intestinal, respiratory, and genito-urinary tracts. At autopsy, the organisms were found in intracardiac blood, the peritoneum and visceral organs. He also found that the pathogenicity

and invasiveness are augmented by the use of mucin as a menstrum for suspending the bacteria.

Direct extension. This is not frequently noted in the post-operative period. It does not involve the study except as a possible cause for post-operative temperature increase.

## CONCLUSIONS

After a review of the literature and the results of our data, we must consider some of the mechanisms of action correlated with the patient procedures.

The bacteremia may be caused by pressure on infected teeth; 1) incidental to intubation of the patient; 2) during the excitement stage and upon waking from anesthesia, or; 3) any time post-operatively that the patient grinds his teeth with pain or with chewing. This bacteremia can cause localization of bacteria at the surgical site, urinary tract, or lung.

It is also possible to have bacterial flora in the trachea and bronchial tree altered following: 1) intubation; 2) decreased cough reflex secondary to narcotic medication or general anesthesia or muscle relaxants with salivary and bacterial material from the mouth being aspirated; 3) decreased ciliary action of the bronchial mucosa secondary to narcotics or general anesthesia.

For future studies on this subject, it would be interesting to note the following observations in addition to those that were done:

1. How much, if any, did the white count increase?
2. How much, if any, did the differential shift?

This would be especially interesting in patients with temperature elevation as the only complication.

3. What was the type and duration of the operation?



Would there have been a greater difference in more traumatic or lengthy procedures?

4. What is the age and sex distribution of the patients?

5. Was the patient catheterized or not?

The random sampling carried out in this series would roughly cancel the above differences in the two groups.

6. What type of oral infection seemed to cause more of the complications or bacterial organisms involved in the oral sepsis?

In this study, it was presumed - rightly or not - that any post-operative antibiotic therapy, catheterization, age, sex, would roughly cancel out in the two groups.

During this study, I did notice a few young people ages 15-25, who had severe periodontitis and gingivitis, but no post-operative complications. Some of the older patients with clinically less severe periodontitis did seem to have complications. Age might well be a factor. The patients without oral sepsis in this study were mainly older edentulous patients and not young, vigorous, "prime of life" patients.

## SUMMARY

Among the 166 patients studied at the University of Nebraska Hospital, the following were noted:

1. Patients with oral sepsis have a greater number and variety of post-surgical complications than do those without oral sepsis.

2. The number of patients with post-operative temperature over 100° F. is statistically significantly increased over the number of those with no oral sepsis.

3. The number of patients with complications is increased by a statistically significant amount in the group with oral sepsis as compared with the group with no oral sepsis.

4. There is a somewhat higher incidence of respiratory tract, urinary tract, and wound infection in the group with oral sepsis as compared to the group without oral sepsis when a general anesthetic is used, but this is not statistically significant. Chi square test was used as a method of statistical analysis in all but the cholecystectomy group.

Further studies are necessary before definite conclusions may be drawn. It does seem logical that oral sepsis should be removed whenever possible before elective surgery.

Table #1. Comparison of complications in patients having dental sepsis with those not having dental sepsis.

	Total Patients	Total Number of Complications	Average Number of Complications per Patient
Patients with Dental Sepsis	123	129	1.05
Patients without Dental Sepsis	43	24	0.56

Table #2. The study of post-operative complications in 166 patients.

	Patients with Complications		Increased Temp. over 100° F.		Wound Infections		Urinary Infections		Respiratory Infections	
	Patients	%	Patients	%	Patients	%	Patients	%	Patients	%
Patients with Dental Sepsis (Total 123 or 74%)	97	80	94	76	17	14	7	6	11	9
Patients without Dental Sepsis (Total 43 or 26%)	21	50	16	37	3	7	1	2	4	9

Some patients had more than one complication.

Table #3. Frequency of complications in patients with and without dental sepsis, having general and spinal or local anesthetics

	Patients with General Anesth. (110)		Patients with Spinal or local Anesthetic (56)		
	With Dental Sepsis	Without Dental Sepsis	With Dental Sepsis	Without Dental Sepsis	
total patients	78	32	45	11	
The post-operative day that the patients temp. returned to below 100°F. in the patients who had elevated temperatures.	I 10	5	6	1	
	II 9	3	7	1	
	III 5	4	3	0	
	IV 23	0	2	0	
	V 21	2	8	0	
	or more				
Incidence of select- ed compli- cations	Wound	12	3	5	0
	Urinary	5	1	2	0
	Respiratory	11	3	0	1

Table #4. Study of 18 of the patients having the same operation, cholecystectomy, all of whom had general anesthetic.

	Patients with Dental Sepsis	Patients without Dental Sepsis
Total patients	11	7
Total patients with Complications	11	5
1 day p.o. temp. 100°F.	3	1
2 day p.o. temp. 100°F.	1	3
3 day p.o. temp. 100°F.	2	1
4 day p.o. temp. 100°F.	0	0
5 or more day p.o. temp. 100°F.	5	0
Wound infections	1	0
Urinary infections	0	1
Respiratory infections	1	0

## ACKNOWLEDGMENTS

I wish to express my sincere appreciation to Doctors Merle M. Musselman, Donald T. Waggener, and Karl W. Bruce for their advice and assistance in the preparation of this thesis.

## BIBLIOGRAPHY

1. Rosenow, E. C. Mouth infection as a source of systemic disease. J.A.M.A. 6:2026-27, 1914.
2. Mitchell, D. F., Hellman, E. Z. The role of periodontal foci of infection. J.A.D.A. 96:32, 1953.
3. Murry, M., Moosnick, F. Incidence of bacteremia in patients with dental disease. J. Lab. Clin. Med. 26:801, 1941.
4. Rogosa, M. et al. Blood sampling and culture studies in the detection of post-operative bacteremias. J.A.D.A. 60:171, 1960.
5. Menkin, U. Newer Concepts of Inflammation. Springfield, Ill., C. C. Thomas, 1950. p. 36.
6. Burke, G. W., Knighton, H. T. The localization of microorganisms in inflamed dental pulps of rats following bacteremia. J. Dent. Res. 39: 205, 1960.
7. Belsey, R. H. R. Intrathoracic suppuration and dental sepsis. Brit. Dent. J. 107:9, 1959.
8. Borrie, J., Donaldson, K. F. Dental sepsis and lung abscess. New Zealand Dent. J. 55:260, 1959.
9. McDonald, J. B. et al. Bacterial mechanisms in periodontal disease. N. Y. Acad. Sci. 85:467, 1959.
10. Weiss, C. The pathogenicity of *Bacteroides melaninogenicus* and its importance in surgical infections. Surgery 13:683-92, 1943.