

The Necessity Of Prophylactic Antibiotics In Paediatric Patients For Dental Treatment Under General Anaesthesia-A Systematic Review

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Abstract:

Aim :

To develop a scientifically current and evidence based protocol on the necessity of prophylactic antibiotics in pediatric patients undergoing dental treatment under general anesthesia based on analyzing the existing literature.

Design:

Electronic databases such as PubMed, Google Scholar, Cochrane and a review of titles,abstracts, and full reports is done to include all randomized controlled trials published between 1990 to December 2017. Hand search of the references of each full report is made and also by use of the 'Related articles' feature.

Result :

The initial search revealed a total of 70 articles from PubMed, Cochrane library,Google Scholar and by hand searching and checking cross-references.After screening of title and abstract,18 articles were identified. Further elimination of duplicate articles resulted in a total of 12 articles.These articles were then further screened according to inclusion and exclusion criteria resulting in a total of 4 studies to be included in the review for further analysis.Out of the 4 included studies, 2 showed moderate risk of bias while 1 showed high risk of bias and the other 1 showed low risk of bias respectively.

Conclusion:

Prophylactic antibiotics are generally given for certain invasive dental procedures in dentistry.Antibiotics are found to be effective in reducing bacteremia and lowering the post-operative temperature elevation after general anesthesia in children.Though it doesnot completely eliminate the bacteremia from systemic circulation, it does reduce it thus making

it a necessity to provide prophylactic antibiotics for children undergoing any dental treatment under general anesthesia. There is a need for more quality randomized controlled trials to evaluate the guidelines for administering prophylactic antibiotics for children undergoing dental treatment under general anesthesia.

Keywords: Children, General Anesthesia, Prophylactic antibiotics, Dental treatment, Bacteremia, Post-operative Temperature Elevation.

Introduction:

The success of any dental treatment for a child lies in the hands of an experienced paediatric dentist. The treatment modalities of young children vary according to the age, behaviour and the dental procedures to be done. It may vary from simple behaviour management techniques to conscious sedation and general anaesthesia. General anesthesia is defined as a drug-induced loss of consciousness during which patients are not arousable, even by painful stimulation.¹

The American Academy of Pediatric Dentistry (AAPD) has recommended general anesthesia (GA) for pediatric dental patients who are unable to co-operate, in whom local anesthesia is ineffective, who are extremely fearful, anxious or uncommunicative, those requiring significant surgical procedures, those who can be benefited from GA protecting them from psychological trauma thereby reducing the medical risks and children requiring immediate, comprehensive oral care.^{2,3}

Children exhibiting extreme anxiety, physically and mentally disabled children, and those in need of an extensive treatment are all candidates for general anaesthesia⁴. Children who are physically and mentally compromised and in need of dental treatment are also indicated for treatment under general anesthesia as they may not allow the safe completion of dental treatment under local anesthesia alone.⁵

Antibiotics are generally recommended to prevent the occurrence of conditions such as post-operative temperature elevations and infective endocarditis due to dental related bacteremias.⁶ There has been reports of a wide range of bacteremia and a wide variety of bacterial incidence on blood cultures after different dental procedures. It has been said that bacteremia commonly occurs from the manipulation of the gingival tissues and that extractions are the most likely to produce bacteremia.⁷ Temperature elevations usually occur after administration of general anesthesia due to tissue destruction, environmental temperature during surgery, administration of certain drugs, dehydration and anaemia for which antibiotics can be administered to overcome it.^{8,9} The purpose of this present systematic review is to evaluate the necessity of antibiotic prophylaxis for pediatric dental treatment under general anesthesia with and without prophylactic antibiotics.

Materials and methods:

Literature search:

A detailed search was undertaken to identify and include all randomized controlled trials which evaluated the outcome of dental treatment done in children and adolescents under General Anaesthesia with or without prophylactic antibiotics. The articles published in the past 27 years were included in the search i.e; from 1990 to December 2017. Electronic

Databases like Pubmed, Cochrane library, Google scholar and cross references were checked to include all possible relevant articles.

Search Strategy:

Child or children or adolescents, antibiotics or antibacterial agents, dental treatment or dental procedure or full mouth rehabilitation, bacteremia or temperature change or complications, general anesthesia

The research question was formulated according to the PICO ANALYSIS:

Population(P): Children and adolescents below 18 years of age who had undergone dental treatment under general anesthesia

Intervention(I): Prophylactic Antibiotics

Comparison(C): Without antibiotics

Outcome(O): Bacteraemia / Temperature change

Inclusion criteria:

All randomized controlled trials which evaluated the outcome of dental treatment of children under General anesthesia with and without prophylactic antibiotics.

Studies involving Children and adolescents below 18 years of age

Studies involving Special children or differently-abled children

Studies published in English language from January 1990 to December 2017

Exclusion criteria:

Studies involving children having one or more of certain systemic illness and conditions like congenital heart disease, aortic stenosis, history of subacute bacterial endocarditis, surgically constructed systemic pulmonary shunts; and other cardiac diseases and conditions, history of rheumatic fever, vascular and joint prosthesis, immune suppression, diabetes, bleeding disorder and antibiotic usage within the past 1 month

Studies which involve individuals above 18 years of age

Articles published in languages other than English

Studies with study design other than randomized controlled trials.

Data Collection and Assessment of risk of bias:

The required information of the eligible studies were collected by one reviewer [Neethu(N)]. However, the information collected was cross-checked by another reviewer [Deepa Gurunathan(DG)]. For each study, the following data was systematically recorded: publication details, sample size, dental procedures done under General Anesthesia, number of samples and sample size according to intervention with or without antibiotic, outcome of the procedure and methodology used for comparison and comparative analysis. (Table 1)

Assessment of risk of bias (Table 2) which includes criteria such as sample size determination, Random sequence generation, Blinding of personnel and participants, blinding of outcome assessor, allocation concealment was done. The risk of bias for each study was evaluated by two review authors [Neethu(N) and Deepa Gurunathan(DG)] and conflicts regarding it were resolved by discussion.

Results:

Study selection:

A systematic search was carried out to identify a total of 70 articles from PubMed, Cochrane library, Google Scholar and by hand searching and checking cross-references. After screening of title and abstract, 18 articles were identified which on further elimination of duplicate articles resulted in a total of 12 articles. These articles were then further screened according to inclusion and exclusion criteria resulting in a total of 4 studies to be included in the review. The major factor for exclusion of studies was studies other than randomized controlled trials. PRISMA Flow chart (Figure 1)

Study characteristics:

Main characteristics of the included studies are discussed in Table 1. The most common method of evaluating the necessity and efficacy of antibiotics was checking for bacteremia and post-operative temperature elevation with and without use of antibiotics by means of recording the temperature change at baseline and post operatively and collecting blood samples at specific intervals and evaluating the bacterial count by means of bacterial culture to assess the bacteremia.

Risk of Bias of the studies:

The details of the assessment of risk of bias for the studies are given in Table 2 and Table 3 respectively. Out of the 4 included studies, 2 showed moderate risk of bias while 1 showed high risk of bias and the other showed low risk of bias respectively. Higher risk of bias is due to the fact that sample size determination was not clearly stated.

Discussion:

In the current arena, there is a worldwide knowledge about general anaesthesia as well as increasing number of children receiving dental treatment under general anaesthesia. The success of any dental procedure done under general anaesthesia in children depends on several factors.^{10,11,12} General anaesthesia is usually indicated^{13,14,15,16} in conditions wherein a child presents with an acute infection like dentoalveolar abscess wherein drug therapy, draining procedures and other pain control methods would be ineffective since even local anaesthetics would be ineffective because of local change in pH and there are increased chances of risk of spreading infections by bacteremia¹⁷.

Prophylactic antibiotics are generally indicated for invasive dental procedures. Some of the common outcomes reported in children undergoing dental treatment under general anaesthesia are bacteremia and temperature elevation. Several studies were done evaluating the outcome of different dental procedures under general anaesthesia including nasal intubation¹⁹ on bacteremia and temperature changes in children and the effect of prophylactic antibiotics on it. Out of which four studies^{7,9,17,18,20} were randomized controlled trials which were included in this systematic review.

Several reasons have been postulated for the incidence of post-operative temperature elevation in children after dental treatment under general anaesthesia. One of the possible causes for temperature elevation after general anaesthesia was considered to be dehydration.^{21,22} Nazif,²¹ in his study attributed this high increase in temperature resulting in fever to the insufficient fluid infusion. Weil²³ attributed atelectasis to be the most common pulmonary complication producing post operative temperature elevation (PTE). The imperfect expansion or collapse of portion of a lung is called atelectasis and may be due to complete reduction in the amplitude of respiratory excursion.²⁴ Such a situation may arise in children when intermittent positive pressure breathing is not employed to ventilate collapsed alveoli or due to anaesthetic agents that depress the normal mucociliary clearance of airways resulting in PTE.^{9,25} Bacteremia is said to be commonly associated with temperature elevation.⁶ However in a study by Holan et al, no significant temperature change was observed between the two groups in which antibiotic was given and not given.⁹ According to a randomized control study by B. Ssneha, Deepa Gurunathan, post operative temperature elevation was seen in 17.07% of cases where antibiotics were given and 66.66% of cases where no antibiotics was given. Thus it states that administration of antibiotics prior to GA administration did prevent post operative temperature elevation following dental procedures¹⁷ and also states that there is a relationship between bacteremia and post operative elevation of temperature in children.

Several studies have been conducted to evaluate the association between bacteremia and the various procedures including the varied stages of dental procedures carried out under general anaesthesia. It was observed that bacteremia was found to be more prevalent in the group where no antibiotics were given compared to the group in which antibiotics were given.^{7,17,18} It was around 18% and 20% after intubation and after dental restoration and cleaning whereas it was 4% and 6% in the antibiotic (amoxicillin) group.⁷ In a study done by Brennan et al, 8 blood draws were taken at specific intervals during the entire dental procedure. The incidence of bacteremia after pulp therapy and cleaning was found to be 20% in placebo group and 6% in the amoxicillin group, and 10 minutes later another blood draw revealed the incidence of 16% bacteremia in placebo group and 0% in amoxicillin group.¹⁸ Naso tracheal intubation is done under general anaesthesia and bacteremia is also observed during that procedure (12.3% cases) and was higher in atraumatic intubation (9.4% cases).¹⁹ Procedures such as rubber dam placement, slow drill, fast drill, matrix band and wedge placement are also said to induce bacteremia and positive blood cultures were observed at 31.1%, 12.2%, 4.3% and 32.1% respectively. This warrants the need of prophylactic antibiotics for some aspects of conservative dentistry too.²⁰ Antibiotics are said to have some effect but are not capable of eliminating bacteremia altogether.¹⁸

Earlier studies suggesting that only invasive procedures like extraction require prophylactic antibiotics should be questioned since nasotracheal intubation which is a routine procedure in general anaesthesia is said to induce bacteremia in children. The incidence of high bacteraemia in conservative dental procedures such as placement of rubber dam, wedge and matrix band suggests a re-examination and correction of the AHA guidelines which suggests no antibiotic prophylaxis are required for rubber dam placement. Also, the post anaesthetic recovery period of thermoregulatory mechanism in younger patients is proved to be short due to antibiotic prophylaxis thereby resulting in speedy recovery.¹⁷ Considering the amount of bacteremia and the increased incidence of temperature elevation after general anaesthesia, antibiotics are indeed necessary before administering general anaesthesia to children to lower the incidence of such complications and consequences.

Conclusion:

Dental treatment for children under general anesthesia is a cautious procedure and steps should be taken to prevent the incidence of bacteremia, temperature elevation and other such complications. Antibiotic prophylaxis is thus recommended to prevent the occurrence of such untoward incidence and complications in children undergoing extensive dental treatment under general anesthesia.

Why this paper is important to Paediatric dentists?:

-Dental treatment under general anesthesia is generally indicated in children for various conditions such as those exhibiting extreme anxiety, physically and mentally disabled children, and those in need of an extensive treatment.

-Paediatric dentists should be aware of the various post-operative complications and the use of prophylactic antibiotics to prevent or reduce its outcome.

-It should be a combined effort by the paediatric dentist, anaesthetist and the parent/guardian of the child to ensure safe completion of the procedure with minimal post-operative complications and the daily care and maintenance of oral health thereafter.

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TABLE 1: OVERVIEW OF INCLUDED STUDIES:

Sr.No.	Name of the author,year of publication	Sample size	Procedure /Procedures done	Prophylactic Antibiotics	Outcome and Result
1	Peter B. Lockart et al,2004	100	Aerobic and anaerobic blood cultures were drawn at 8 specific time points after intubation, dental restorative and cleaning procedures, and before,during and after dental extractions	2 groups-one group was given Amoxycillin elixir(50 mg/kg) and the other group was given a placebo	Positive blood culture was significantly higher in the placebo(84%) than the amoxicillin group(33%).Bacteremia occurrence rates after intubation and after dental restorations and cleaning were 18% and 20% in the placebo group and 4% and 6% in the amoxycillin group.At 1.5 minutes after initiation of dental extraction, bacteremia occurred in 76% of the placebo group versus

					15% of the amoxicillin group.
2	Gideon Holan et al,1993	26	Full mouth rehabilitation was done and Temperature was measured rectally before administering premedication,at the beginning of procedure, end of procedure and every hour thereafter till patient was discharged.	2 groups- Study group received a single oral dose of amoxicillin syrup 25 mg/kg b.w. 1 hour before the procedure. Control group: received a flavoured ayrup as placebo	13 patients showed post-operative temperature elevation more than or equal to 37.9 degree Celsius of which 6 belonged to study group and 7 belonged to control group.No significant difference between study and control group.
3	Michael T.Brennan et al,2007	100	8 blood draws were taken at specific	2 groups:Study group-amoxicillin	Incidence of bacteremia from draw 2(pulp therapy and

			intervals during the entire dental procedure.	20 mg/kg and control group- placebo 1 hour before the proedure	cleaning) was 20% in placebo group and 6 % in amoxicillin group, and the incidence from draw 3 (10 minutes later) was 16% in placebo and 0% in amoxicillin group. Although antibiotics have an effect, they donot eliminate bacteremia altogether.
4	B.Sneha,Dr. Deepa Gurunathan ,2015	83		2 groups- study group:amoxi cillin 25mg/kg b.w. was given(41) and control group-no antibiotics given(42)	Post operative rise in temperature:42. 1% of patients.In study group it was observed in 17.07% cases and in the control group it was observed in 66.66% cases.Antibiotic prophylaxis was effective in reducing post operative temperature elevation.

**TABLE 2:
RISK OF BIAS GRAPH**

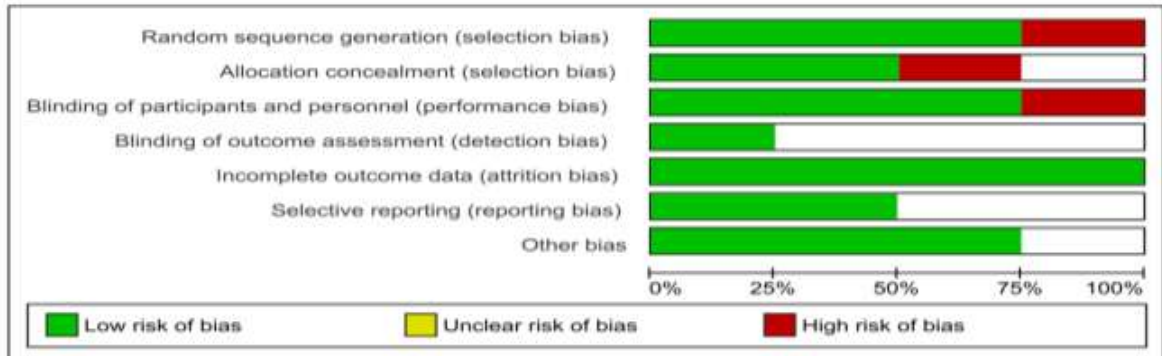


TABLE 3: RISK OF BIAS SUMMARY

	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding of participants and personnel (performance bias)	Blinding of outcome assessment (detection bias)	Incomplete outcome data (attrition bias)	Selective reporting (reporting bias)	Other bias
B.Sneha And Deepa Gurunathan	●	●	●		+	+	
Brennan et al. 2007	+	+	+		+		+
Holan et al. 1993	+		+	+	+	+	+
Peter B. Lockart et al. 2004	+	+	+		+		+

PRISMA FLOW-CHART

Figure 1: PRISMA CHART

