

Clinical Research

When and How Should Antibiotic Prophylaxis and General Anesthesia Be Used in Down Syndrome Patients Receiving Dental Treatment?

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ABSTRACT

Objective: Dental treatment for Down's syndrome is often carried out under general anesthesia due to the difficulty of cooperation, excessive dental procedures, and accompanying systemic diseases. The risk of endocarditis can be avoided by maintaining good oral hygiene, preventing tooth decay and administering prophylactic antibiotics before some dental treatments.

Material and Method: Down Syndrome patients underwent dental treatment under general anesthesia were evaluated retrospectively. General anesthesia method, demographic variables, ASA scores, Oral Hygiene Index, Frankl scale, Houpt Scale, systemic diseases of the patients, antibiotic prophylaxis and dental treatments were examined as data.

Results: Female/male ratio was 62/51, mean age was 14.14±10.28. Most patients were ASA II with 67.3%. The oral hygiene index was poor (%38). While 84.81% of the patients were sedated, 15.2% were given general anesthesia. Tooth extraction with tooth filling was the most performed dental treatment. The most common systemic disease was of cardiac origin. Antibiotic prophylaxis was administered to 82 of the patients.

Conclusion: To treat patients with Down Syndrome, frequent use of general anesthesia and sedation, as well as frequent antibiotic prophylaxis, is required. In terms of these applications, it is necessary to create a treatment plan with the least risk to the patient.

Keywords: General Anesthesia, Oral Surgery, Down's Syndrome, Antibiotic Prophylaxis.

ÖZ

Diş Tedavisi Gören Down Sendromlu Hastalarda Antibiyotik Profilaksisi ve Genel Anestezi ne Zaman ve Nasıl Uygulanmalıdır?

Amaç: Down sendromunda diş tedavileri, kooperasyon güçlüğü, çoklu dental işlemler ve eşlik eden sistemik hastalıklar nedeniyle sıklıkla genel anestezi altında yapılmaktadır. İyi bir ağız hijyeni sağlayarak, diş çürümelerini önleyerek ve bazı diş tedavilerinden önce profilaktik antibiyotik uygulayarak endokardit riskinden kaçınılabılır.

Gereç ve Yöntem: Genel anestezi altında dental tedavi yapılan Down Sendromlu hastalar retrospektif olarak değerlendirildi. Genel anestezi yöntemi, demografik değişkenler, ASA skorları, Oral Hijyen İndeksi, Frankl skalası, Houpt Skalasını, hastalara ait sistemik hastalıklar, antibiyotik profilaksisi ve diş tedavileri veri olarak incelenmiştir.

Bulgular: Hastaların yaş ortalaması 14,14 ±10,28 ve Kadın/erkek oranı 62/51 idi. Hastaların çoğu %67,3 ile ASA II idi. Oral hijyen indeksi zayıftı (%38). Hastaların %84,81'ine sedasyon uygulanırken, %15,2'sine genel anestezi uygulandı. Diş dolgusu ile diş çekimi en fazla yapılan dental tedavilerdi. En sık görülen sistemik hastalık kalp kaynaklıydı. Hastaların 82'sine antibiyotik profilaksisi uygulandı.

Sonuç: Down Sendromlu hastaların tedavisinde sık genel anestezi ve sedasyon kullanımı ve sık antibiyotik profilaksisi gereklidir. Bu uygulamalar açısından hasta için en az risk içeren bir tedavi planı oluşturmak gerekmektedir.

Anahtar Sözcükler: Genel Anestezi, Ağız Cerrahisi, Down Sendromu, Antibiyotik Profilaksisi.

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Oral health is very important for individual growth and development. However, oral health care is even more critical in patients with special health needs. "Special needs patients" are used to describe adults and children for clinical diagnosis and functional development. People with special health needs complain of systemic disorders such as developmental, physical,

sensory, behavioral, mental, cognitive or emotional disorders (1).

Down syndrome (DS) is one of them, first described by Langdon Down in 1866, and has an incidence of 1.5 per 1000 live births (2). It is the most common congenital mental anomaly, including several mental and behavioral alterations and physical malformations (3,

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4). Moreover oral health of children with Down's syndrome; can be adversely affected due to medications, treatments, or difficulties in daily basic tooth cleaning (5). It requires particular relevance and professional care due to mental disability and health problems (6).

Current dental problems can be treated with general anesthesia due to the lack of cooperation of patients, excessive dental procedures, and accompanying systemic diseases (1, 7). Depending on the patient's condition, procedures ranging from minimal sedation to deep general anesthesia are performed (8, 9).

Children with Down syndrome are born with certain anatomical characteristics specific to the condition, including atypical fingerprints, small teeth, stunted growth, droopy ears, hypotonia, and a flattened nose (8, 10). As these patients age, they often experience increased obesity, which can pose challenges for vascular access (11). Moreover, these individuals commonly exhibit enlarged tonsils and adenoids, a narrowed subglottic area, a prolapsed epiglottis, and an enlarged tongue (10, 12). Specifically, their tonsils and adenoids are larger, the subglottic area is smaller, the tongue is enlarged and the epiglottis may droop (10, 12). Approximately 10% to 40% of individuals with Down syndrome also have atlantoaxial instability (13). Therefore during treatment it is crucial to minimize head extension to prevent subluxation. Due to these unique characteristics, advanced airway devices should be readily available for intubation, as airway management can be complex (14). It is not recommended to administer sedation to these patients in office settings and more specialized operating rooms are required (15).

Individuals with Down syndrome are at a higher risk of developing various systemic conditions, including cardiovascular diseases, leukemia, infections, osteoporosis, and endocrine, neurological, orthopedic, dental, auditory, and ophthalmic disorders. Approximately 40-50% of them exhibit ventricular septal defects, a type of congenital heart defect, which may necessitate antibiotic prophylaxis for invasive dental treatments (16). Differences in their immune systems, zinc deficiency and anatomical variations make these individuals more susceptible to infections (17). Consequently, compromised dental health can pose a systemic disease risk, especially in those with concurrent medical issues. Therefore prophylactic regimens should be implemented to mitigate potential risks for the patients (17, 18).

First, when treating children with DS, the need for subacute bacterial endocarditis prophylaxis should be determined. The clinical importance of bacteremia in healthy patients is low. However, in a patient prone to local bacterial colonization following a bacterial infection, microorganisms may colonize through circulation and become a life-threatening condition such as infective endocarditis (17). IE prophylaxis should be given before dental treatment of such diseases to obtain an appropriate serum antibiotic concentration.

In this retrospective study, considering all the above-mentioned risky situations, we aimed to determine the limits of when and how antibiotic prophylaxis and

general anesthesia should be used in patients undergoing dental treatment with Down syndrome.

MATERIAL AND METHOD

1. Study population and ethical approval

After obtaining the local ethics committee of the Süleyman Demirel Faculty of Medicine. The study was conducted between April 2014 and April 2018. Süleyman Demirel University Faculty of Medicine General Anesthesia Unit. Clinical interventions, comorbidities, use of prophylactic antibiotics, and the demographic characteristics of patients who underwent interventions under anesthesia in the operating room of the "Disabled Oral and Dental Health Hospital" were analyzed retrospectively. The patients who lacked medical information were excluded from the study.

Inclusion criteria: patients who underwent dental treatment with general anesthesia and only those with Down's syndrome. Dental treatment cannot be performed with local anesthesia due to exclusion criteria (patients undergoing local anesthesia and patients without information in their medical records).

2. Evaluation of general health

Due to the increase in life expectancy in patients with Down Syndrome, dental treatments are also a serious public health problem that is frequently on the agenda. Social awareness is essential to solve the problem without further difficulty. Dental treatment of DS patients is started before, especially by the pedodontics clinic, by screening the schools for disabled patients. These are the ones detected due to these scans in some patients who are operated under general anesthesia.

3. Evaluation of oral health

Routine examinations of the patients were carried out, whether they applied to the clinic themselves or were determined by the health screenings. Oral and dental examinations and radiological imaging were performed. Especially incompatible patients who could not be thoroughly examined and whose imaging could not be performed to the desired extent were sent to the anesthesia evaluation polyclinic. Patients planned to be operated on under general anesthesia were evaluated according to Frankle (F) and Houpt (H) scales. Patients with F1-2 and H1-2 were included in the appointment list for general anesthesia or sedation (19, 20).

4. Dental treatments

Although periodontological disease is a common problem in DS patients, our patients received general anesthesia or sedation to treat the following diseases.

Preventive treatment includes systematic scaling/cleaning, fluoride application, and placement of sealants where appropriate.

Restorative treatment: It is the treatment that includes the restoration of material losses in the hard tissues of primary teeth and permanent teeth.

Surgical procedures: The surgical treatment comprises various procedures such as extractions of both simple

and impacted teeth, gingivectomies, frenectomies, and other minor oral surgeries. Additionally, it involves surgical interventions for dental implants, jaw fracture repair, removal of cysts in the jawbones, maxillary expansion through surgical implantation, as well as plaque placement and removal operations.

Examination under anesthesia (without intervention)

5. Preoperative evaluation

The patients were evaluated preoperatively, and a physical examination was performed. Blood tests and consultation were required, if necessary. Comorbidities and drugs used were recorded, and necessary precautions were taken. All patients were fasting for at least 6 hours for sedation and general anesthesia. Information was given about the anesthesia procedure, and written informed consent was obtained from the legal guardians of the patients after the necessary explanations about possible risks.

6. Antibiotic prophylaxis

Prophylaxis was given to those with cardiac disease and immune problems. Usually, penicillin was used. Cephalosporins were used for allergy sufferers.

7. Intra-operative period

During the dental procedure, peripheral oxygen saturation, heart rate, blood pressure, and end-tidal carbon dioxide levels were continuously monitored in accordance with the guidelines set by ASA. Based on the patients' medical condition and their ability to cooperate, various anesthetic agents and techniques were employed to ensure optimal safety and comfort.

8. Post-operative period

At the end of the procedure, the patients were monitored for about 20 minutes in the recovery unit. The patients were taken to the inpatient unit without any decrease in vital functions. Oral nutrition started after 1 hour in patients undergoing sedation with an inhalation agent, after 2 hours for those undergoing sedation with an intravenous agent, and after 4 hours, respectively, for general anesthesia. Patients who tolerated oral intake were discharged the same day. The patients who could not take oral treatments because of nausea and vomiting or those who needed time to recover were followed up and treated in the inpatient service for 24 hours

9. Statistical analysis

The data obtained from the study was recorded in Microsoft Excel 2010. Subsequently, the data were subjected to analysis using the SPSS software package (version 17.0, SPSS Inc., Chicago, Illinois, USA). Descriptive statistics, including frequencies, percentages, and mean±standard deviations, were calculated. The study variables were subjected to a descriptive analysis, wherein arithmetic means, frequencies, and percentages were computed and presented in the form of tables.

RESULTS

Files of 8294 patients who received general anesthesia or sedation for dental treatments between April 2014 and April 2018 were retrospectively reviewed. One Hundred Forty-Nine DS patients underwent the procedure. Those with missing data and those without consent to the study were excluded. The first applications of those with more than one procedure in the same patient were accepted into the study. A total of 113 patient data were evaluated for the study. The patients age was 14,14±10,28 (2-44) years, 54.8% were male, and 45.2% were female. The oral hygiene index was poor at 38% and fair at 43%. While 84.81% of the patients were sedated, 15.2% were given general anesthesia. Sedation was preferred in most of the patients. Ketamine + Midazolam was used most frequently. Intubation was performed with a video laryngoscope in patients who received general anesthesia. The most common perioperative complication was bradycardia. Restorative+tooth extraction was the most common dental treatment (80%). Antibiotic prophylaxis was administered in 73% of the patients (Table 1).

Table 1. General Characteristics of Patients with Down syndrome.

| | |
|---------------------------------------|--------------------|
| Age (Mean),year | 14,14 ±10,28(2-44) |
| Gender | n (%) |
| Male | 62 (54,8) |
| Female | 51 (45,2) |
| Oral Hygiene Index- Simplified | n (%) |
| Excellent | 0(0) |
| Good | 21 (18,6) |
| Fair | 49(43,4) |
| Poor | 43(38,0) |
| Anesthesia Procedure | n (%) |
| Sedation | 96 (84,8) |
| General | 17 (15,2) |
| Applied Dental Treatments | n (%) |
| Preventive treatment | 21(18) |
| Restorative treatment | 89(80) |
| Surgical treatment | 3(2) |
| Antibiotic Prophylaxis | 82(73) |

The most common systemic disease was of cardiac origin. The most common of these was the operated VSD (Table 2).

Table 2. Concomitant diseases.

| | |
|--|------------------|
| Diabetes Mellitus | 5 |
| Hipotroidi | 25 |
| Hearing loss | 8 |
| Sleep apnea | 40 |
| Epilepsy | 14 |
| Cardiac disease | 58 |
| Repaired Ventricular septal defects | 22 |
| Repaired Patent ductus arteriosus | 10 |
| İsolated Atrial septal defect | 7 |
| İnfective endocarditis (before) | 11 |
| Pacemaker | 3 |
| Arrhythmia | 5 |
| Total Number of Patients: (some patients have more than one systemic disease: total number 150) | 113 (100) |

According to the Frankl scale, 21% of the patients were F1(n= 24), 79% were F2 (n= 89), according to the Houpt Scale, 33% were H1 (n= 37), and 67% were H2 (n= 76). In the absence of ASA1 patients, ASA2 was 67.3% (n= 76), and ASA3 was 32.7% (n= 37) (Table 3).

Table 3. Frankl scale, Houpt Scale and ASA classification (20, 21).

| Frankl scale for evaluating behaviour (modified). | | |
|--|----------------|--|
| Category 1 | F1 | Total lack of cooperation |
| Category 2 | F2 | Signs of lack of cooperation |
| Category 3 | F3 | Accepts treatment with caution. May require reminders (open mouth, hands down, etc..). |
| Category 4 | F4 | Very cooperative. No sign of resistance. |
| Houpt Scale for evaluating movement | | |
| Category 1 | H1 | Violent movement constantly interrupting examination |
| Category 2 | H2 | Constant movements that hinder examination |
| Category 3 | H3 | Controllable movements that do not interfere with the procedure |
| Category 4 | H4 | Lack of movement |
| ASA classification Physical status | | |
| Category 1 | ASA-I | Normal healthy person |
| Category 2 | ASA-II | People with mild systemic disease |
| Category 3 | ASA-III | People with severe systemic disease, not incapacitating |
| Category 4 | ASA-IV | People with severe systemic disease that is a constant threat to life |
| Category 5 | ASA-V | Moribund people who are not expected to survive without the operation |

When the patients were evaluated in terms of general anesthesia indications, 33% were Group A, 17% were Group B, and 50% were Group C (Table 4).

Table 4. Indications for the use of general anaesthesia for dental treatment.

| Group | Patients characteristics |
|----------------|---|
| | Patients with general medical problems When it is risky to treat them in the usual way Sensory or mental problems. |
| GROUP-A | Physical disabilities with uncontrollable motor deficits make it impossible for them to collaborate. Local anaesthesia is not effective or for reasons of allergy. Uncontrollable epileptic crises. |
| | Patients with extensive dental needs. When it is impossible to treat them in the clinic and for some reason they must be treated in a single session. Extensive orofacial trauma or fractured maxillae. With serious craneo-facial anomalies and the need for extensive dental care. This includes extractions, which are usually multiple, even in patients without other added problems |
| GROUP-B | |
| | Patients who do not collaborate. For reasons of fear or phobia. Because of incapacity for collaborating because of a physical or mental impairment or immaturity (age). Because treatment is rejected violently and any other type of control is impossible. Cases of severe autism and psychosis with uncontrollable behaviour. |
| GROUP-C | |

DISCUSSION

The most common syndrome in all societies is Down syndrome. The treatment of these patients is a public health problem. The expected life expectancy in this syndrome, accompanied by systemic diseases, has been increasing since the 1800s when the syndrome was defined. Dental treatments are also commonly performed on these patients. In our clinic, approximately 4% of all our patients are special needs patients. DS patients constitute 60% of these patients (22, 23).

DS patients often suffer from periodontal disease due to poor oral hygiene, a ketogenic diet, and inadequate oral care. They need restorative treatment more often than their peers. Some patients need orthodontic treatment due to tooth deficiencies and anomalies, and they may be indicated for prosthesis applications at an earlier age. It has become commonplace under today's conditions to talk about dental implant treatments in these patient groups. All these treatments are performed in our clinic under general anesthesia or sedation (23). Consistent with the literature, most patients (80%) underwent conservative treatments, including restorative and tooth extractions. While patients who apply to the oral diagnosis department of the faculty of dentistry are directed to the relevant departments according to the treatment requirement, these patients, most of whom are in the pediatric age group, are treated in the general operating room, especially because of difficulty in cooperation (22).

Preoperative evaluation in patients to be treated under general anesthesia or sedation; The duration of the procedure, the intensity of systemic problems, and difficult airway control are considered. While general anesthesia is preferred for long-lasting procedures, the patient may decide to divide the procedures and perform them under sedation instead of general anesthesia, which may pose a high risk due to serious systemic problems. Or in a patient with a difficult airway, even if the procedure is short, if it is a problem to protect the airway safely during sedation, intubation can be preferred, and the patient can be directed to general anesthesia (8). Dental treatments can be postponed in patients with ASA III and above because they are not so important that they do not require taking a life risk. Our study shows that the sedation/general anesthesia rate is approximately 85/15%. For the reasons mentioned above, sedation preference is more important. The available data are compatible with the literature.

In particular, general anesthesia offers a relatively safe option for managing patients with behavioral and adjustment problems (24). Although it suggests that these patients are at higher risk of perioperative complications due to the presence of medical comorbidities, the available literature reports that these occur at a similar rate or less frequently than in the general population (9). In addition, even minor morbidities may occur more prominently in patients with special needs (10). Therefore, comprehensive preoperative evaluations are

crucial to reduce the risk of surgery-related complications, especially in this cohort.

Around 50% of infants with Down syndrome are born with some form of heart abnormality. Among adults with Down syndrome, approximately 50% exhibit Mitral Valve Prolapse (MVP) and may require prophylactic antibiotics prior to undergoing dental procedures (17). According to our study, heart disease is the most common systemic disease accompanying DS. Among these, VSD is the most common. IE prophylaxis is recommended, especially in problems involving the heart valves. In surgical interventions, antibiotic prophylaxis is performed to provide sufficient antibiotic levels in the tissue during and immediately after surgery, reduce bacterial flora, and reduce the possible contamination to the level the host can resist. The high need for antibiotic prophylaxis is closely related to cardiac diseases (25). These indications can be listed as follows: History of previous infective endocarditis, Prosthetic Heart Valves, hypertrophic cardiomyopathy, Acquired heart valve diseases, Complex congenital cyanotic heart diseases Surgically corrected systemic or pulmonary shunts, Non-cyanotic congenital heart diseases (except secundum type ASD), Mitral valve prolapse with valvular insufficiency or severe valve thickening (26).

Invasive procedures that may cause bleeding should be considered when performing prophylaxis. While there is a prophylaxis indication for tooth extraction, prophylaxis is not applied for a simple procedure such as fissure sealant in the same patient. Antibiotics used in prophylaxis and their doses are given in table 5.

Table 5. Recommended prophylaxis in dental procedures ¹⁸.

| Condition | Antibiotic | Single dose 30-60 minutes before the intervention | |
|--|-----------------------------|---|------------------------|
| | | Adult | Child |
| No allergies to Penicillin or Ampicillin | Amoxicillin or Ampicillin * | Oral / i.v. 2 g | Oral / i.v. 50 mg / kg |
| Allergic to Penicillin or Ampicillin ** | Clindamycin | Oral / i.v. 600 mg | Oral / i.v. 20 mg / kg |

The greatest risk that may arise due to antibiotics is anaphylaxis, which resolves with medical treatment. However, if IE occurs, it is necessary to struggle with a seriously complicated situation, which may have mortal consequences (18). Antibiotic prophylaxis was required in 73% of the patients treated in our clinic. We did not see any side effects from antibiotics in these patients. Penicillin was used frequently. Cephalosporin was preferred in patients with a history of allergy. We have also experienced that patients with DS need

prophylaxis more frequently for dental procedures than healthy patients of the same age group.

The sensitive issue here is to take adequate precautions to solve the problem smoothly or with fewer problems. While the intensity of medical problems in DS patients who will receive dental treatment poses a risk regarding general anesthesia, antibiotic prophylaxis increases some risks due to cardiac disease and immune problems. For this reason, dentists should focus on solving the problem with a holistic approach. Dentists should address these patients as both a public health problem and a personal problem requiring individual treatment outside their routine practice (27). When the subject is handled from this point of view, the issues we draw attention to as two main topics in our study come to the fore.

As emphasized in the literature in our study, taking adequate precautions and working with the right team and equipment provided good results contrary to fears. While the anesthetic literature does provide assessments regarding patients with special needs, clinicians must acknowledge the challenges associated with evaluating such individuals (20). Furthermore, the presence of multiple disorders, medical conditions, and anatomical and physiological changes can considerably complicate this process, particularly when comprehensive information is not readily accessible.

Conclusion

DS is a collaborative group of diseases that require dental treatment with increasing frequency and require a unique approach; a clinically individual approach is mandatory. Two crucial issues that complicate the current treatment of these patients are the necessity of performing the procedure under general anesthesia and the need for antibiotic prophylaxis. In our study, it will be helpful to consider both issues in light of the literature regarding reaching guiding tips for professionals who provide medical care to these patients. Based on the literature and the data of our study, we understand that; General anesthesia and sedation will be used more frequently in treating patients with DS. General anesthesia or sedation is absolutely necessary in patients with systemic diseases accompanying Down syndrome, long-term dental treatments and patients who cannot adapt. Especially in heart valve patients, bacteremia that may occur during dental treatments includes fatal risks. Antibiotic prophylaxis will be administered more frequently to these patients for cardiac or other systemic reasons. The important thing is to know the benefits of these applications, to take the necessary precautions, and to make the treatment of the patients without any risk and with a more accurate approach.

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