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MANAGEMENT OF TYPE 2 DIABETIC PATIENT UNDERGOING BIMAXILLARY ORTHOGNATHIC SURGERY UNDER GENERAL ANAESTHESIA

Dental Science

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ABSTRACT

We describe a case of a patient referred by his orthodontist to our oral and maxillofacial surgery department, who presented with a chief complaint of protruded lower jaw deformity complicated by a medical history of type II diabetes. His skeletal deformity is diagnosed as class III skeletal malocclusion, related to retrognathic maxilla and mandibular hyperplasia. In this case report, we will mainly discuss the perioperative management of the patient's diabetic condition in preparation for bimaxillary orthognathic surgery under general anaesthesia, by using the insulin-glucose-potassium regimen.

KEYWORDS

type 2 diabetes, orthognathic surgery, glucose-insulin-potassium, GIK

Introduction

According to the World Health Organization (WHO), diabetes is accounting for 422 million cases worldwide.("The Lancet. "Number of adults with diabetes reaches 422 million worldwide, with fastest increases in low and middle income countries." ScienceDaily. ScienceDaily, 6 April 2016.

<www.sciencedaily.com/releases/2016/04/160406074921.htm>.") In Saudi Arabia, the prevalence of diabetes is estimated to be around 14.7 % in males and 13.8 % in females, with a total of 14.4 % general prevalence in the Saudi population.(WHO, 2016) Type I diabetes, formerly named insulin-dependent diabetes mellitus (IDDM) or juvenile diabetes, is an immune mediated condition and it results from pancreatic B cell destruction, which leads to an actual deficiency of insulin. On the other hand, type II diabetes, also known as non-insulin-dependent diabetes mellitus (NIDDM), is associated with insulin resistance in the receptor cells. Diabetic patients are known to have increased mortality and morbidity and this is of higher concern in uncontrolled diabetics. In surgical patients, healing is severely impaired when blood glucose levels are uncontrolled.(Retzepi & Donos, 2010)

Orthognathic surgical techniques have been extensively discussed in the medical and dental literature, but few cases have been reported in the perioperative management of type II diabetic patients suffering from skeletal deformities undergoing general anaesthesia.(Nakayama, 2015) In this case report, we aim to discuss the perioperative management of a type II diabetic patient with a class III skeletal malocclusion deformity, managed by bimaxillary orthognathic surgery under general anaesthesia.

Case report

A 22-year-old Saudi male patient was referred by his orthodontist to the Oral and Maxillofacial Surgery Department at Dammam Medical Complex, in July 2017, for the treatment of his class III skeletal malocclusion jaw deformity. The patient's chief complaint was the inability to chew his food properly. He has a medical history of type II diabetes mellitus that was managed by oral antihyperglycaemic medication (metformin).

A comprehensive clinical and radiographic assessment of the patient's facial deformity was carried out. The facial proportions measurement, orthopantomographic (OPT) evaluation, and lateral cephalometric analysis, all confirmed a clinical diagnosis of class III skeletal malocclusion. The patient's jaw deformity is related to retruded hypoplastic maxilla and hyperplastic protruded mandible. No facial asymmetry was observed. The diagnosis and treatment plan were discussed with the patient, special consideration was emphasized given his diabetic condition, and an informed surgical consent was obtained. The patient sent back to his orthodontist to commence phase 1 presurgical orthodontic treatment to decompensate and align the upper and lower dental arches, in preparation for the surgical phase. The orthognathic surgical treatment plan was to advance the maxilla with a Le fort I osteotomy and setback the mandible with bilateral sagittal split osteotomy (BSSO) with advancement genioplasty. The goal of bimaxillary orthognathic surgery was to achieve a class I skeletal and dental relationship, improve the patient's aesthetic facial profile and give a better quality of life in terms of deglutition.

During presurgical follow up, the patient had informed the surgeon that his glycaemic control was suboptimal and a preoperative laboratory test of glycosylated haemoglobin (HbA1c) was requested, revealing 8.0 % (normal range 4.0 – 5.6 %). This value is equivalent to an average blood glucose of 183 mg/dl, indicating an uncontrolled glucose level during the past 3 months.

In April 2018, the patient was booked for surgery under general anaesthesia, after completing his phase 1 orthodontic treatment. On the day of admission, a consultation with the medical diabetic team was done according to our hospital protocol. After the medical assessment, the patient has been placed on standard glucose-insulin-potassium (GIK) regimen for type 2 diabetic patients, treated with oral hypoglycaemic agents, with mild to moderate hyperglycaemia, and who are clinically stable.

The day before the surgery, the oral antihyperglycaemic agent (metformin) withheld. On the night before the surgery, the patient was instructed to fast at 12 am, with a plan to take him to the operating theatre early in the morning. Standard glucose-insulin-potassium (GIK) regimen was started. This GIK regimen is based on 10 units of short acting insulin added to a 500 ml 10 % dextrose solution with 10 mmol potassium chloride (Kcl). Before beginning infusion, the blood glucose was measured using glucometer and it gave a reading of 257 mg/dl. After that, GIK infusion was started a t a rate of 100 ml/hr, over a period of 5 hours, to reach a target of 120 to 180 mg/dl. On the day of the surgery, immediate preoperative glucose reading was obtained giving a reading of 137 mg/dl. Based on this glucose level, this patient was treated as a non-diabetic patient by administering 5 % dextrose only, with continuous monitoring of blood glucose levels every 2 hours intraoperatively.

Before the initial surgical incision, cefazoline intravenous infusion of 2000 mg was administered 30 minutes preoperatively. Also, dexamethasone intravenous infusion of 8 mg was given. This is a routine protocol for maxillofacial surgery patients in our hospital. The patient underwent general anaesthesia and bimaxillary orthognathic surgery was performed by advancing the upper jaw and mandible setback with advancement genioplasty. There were no complications during the surgery and the patient recovered from general anaesthesia without any problems. After the patient fully recovered from general

anaesthesia and transferred from the recovery room to the ward, he was encouraged to commence oral intake with cold liquid diet. With continuous random blood glucose assessment, the patient had a range of acceptable values ranging from 140-160 gm/dl. Metformin was immediately resumed as soon as the patient had adequate oral food intake.

Discussion

Orthognathic surgery is a commonly performed procedure by oral and maxillofacial surgeons for correcting dentofacial deformities. These procedures are reliable and safe if appropriate surgical principles were strictly followed. One of these principles is the preoperative patient overall health assessment, which is a key factor for optimal patient management and essential in reducing potential complications. Up to our knowledge, few reports have been written in the management of diabetic patients undergoing orthognathic surgery.(Nakayama, 2015)

In our case report, we presented a case of a 22-year-old Saudi male, with a medical history of type 2 diabetes, who was complaining of difficulty chewing his food. This young male patient was diagnosed with class III skeletal malocclusion related to hypoplastic maxilla and prognathic mandible. His jaw deformity was planned to be surgically corrected with bimaxillary orthognathic surgery and advancement genioplasty. The surgical management was complicated by his uncontrolled type 2 diabetes condition. In order to best manage this patient, a medical consultation, with the diabetic care team, was sought upon admission day. They have recommended an insulin sliding scale to manage the patient's uncontrolled blood glucose level, by applying glucose-insulin-potassium (GIK) regimen.

Type II diabetes is the most common type of diabetes and it is one of the major causes of mortality globally.(du Toit, 2018) In surgical patient's, the perioperative phase is highly associated with worsening blood glucose levels that are related to many factors including, starvation before and after surgery. In maxillofacial surgery cases this is a special concern as the nature of these surgical procedures hinder normal oral food intake. Furthermore, glucose balance, in those patients, is negatively affected by surgical trauma and pain, in which the patient's status is affected multiple days during the patient's stay in the hospital.(Duggan, Klopman, Berry, & Umpierrez, 2016) Also, metabolic changes in response to surgery result in catabolic processes, involving gluconeogenesis, glycogenolysis, proteolysis, lipolysis, and ketogenesis. All lead to a patient with hyperglycaemic and ketotic condition.(MJ Elliott, 1983; Yoo & Serafin, 2006)

Glycosylated haemoglobin (HbA1c) is used to screen the patient's overall compliance with his treatment that is prescribed by his physician. HbA1c is an effective and reliable method to screen the patient's blood glucose levels during the last 3 months.(Song et al., 2018) The normal range is usually between 4 and 5.6 % and our patient had a preoperative screening value of 8 %, indicating a substandard patient compliance with treatment. This value may reflect patient uncontrolled diet habit, unhealthy life style, or irregular medication intake. In elective surgical procedures, an elevated glycosylated haemoglobin percentage exceeding 8.5 % warrants postponement of the procedure.(Barker et al., 2015; K. Dhatariya, Levy, & Hall, 2016; K. K. Dhatariya et al., 2018)

In this case report, the patient's perioperative glycaemic control was managed by glucose-insulin-potassium (GIK) regimen. This specific protocol is especially targeted for type 2 diabetic patients, treated with oral hypoglycaemic agents, with mild to moderate hyperglycaemia, and who are clinically stable. It provides a single substrate of intravenous insulin and electrolyte in a single infusion method. Originally, GIK regimen was published by Alberti and Thomas, in 1979, and it uses a bag containing 500 ml 10 % dextrose with added 10 units of short acting insulin, and 10 ml 10 % potassium chloride (KCl).(Alberti & Thomas, 1979) The infusion must run at a fixed rate of 100 ml/h (providing 2 units of insulin in 1 hour). The blood glucose should be measured every 1 to 2 hours. This protocol is started after the patient stopped Metformin oral antihyperglycemic medication, and before the surgery day. This is to give a sufficient time to adjust the patient's blood glucose by GIK regimen, which consumed a 5-hour time period with this patient. Our patient reached an appropriate level of blood glucose around 137 mg/dl to undergo surgery under general anaesthesia. At this immediate preoperative glucose level, the patient insulin infusion was stopped and a 5 % dextrose infusion was sustained during the surgery time, to avoid a hypoglycaemic complication in this somewhat lengthy bimaxillary orthognathic surgery. Postoperatively, the goal, in such kind of cases, is to encourage patients to start normal oral food intake as tolerated, as soon as the patient recovers from general anaesthesia, and to resume the usual antidiabetic oral medications. During this transition of nutritional and medication requirements, monitoring of blood glucose level of utmost importance to avoid unwarranted complications.

Conclusion

Successful perioperative management of diabetic patients, undergoing orthognathic surgical interventions, is very important for optimum overall patients care and management. These patients are of special concern as they are subjected to prolonged starvation during preoperative, intraoperative, and postoperative periods. Blood glucose optimization during this period will prevent many complications. The principles to be stringently followed are to reduce mortality and morbidity, to avoid excessive hyperglycaemia or hypoglycaemia, and to avoid ketosis. The use of GIK regiment with continuous monitoring of the patient's condition can reduce the potential metabolic derangement and its subsequent complications during surgical stress.

Conflict of interest

The authors confirm they have no conflicts of interest.

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