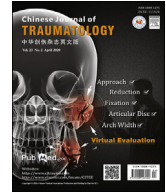




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Case Report

Maxillofacial trauma in a pregnant patient: Contemporary management principles with a case report & review of literature

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ABSTRACT

Trauma during pregnancy deserves special attention because of its management objectives, i.e. well-being of both pregnant woman and foetus. Maxillofacial trauma directly affects the nutrition of foetus by interfering with the normal functions in a pregnant woman such as mouth opening, mastication and breathing. Hence early restitution of form and function of maxillofacial skeleton is essential. However, the gravid status is associated with numerous anatomical and physiological changes which present with clinical dilemma related to imaging and treatment. A careful scrutiny of the patient's systemic and gestational status is absolutely essential before, during and after instituting any interventional procedures. We present a case of bilateral condyle fracture in a 30-year-old pregnant woman in the third trimester (32 weeks). She was treated with inter maxillary fixation using orthodontic brackets & elastics. After successful restitution of occlusion, the patient was advised aggressive physiotherapy which ensured normal mouth opening. Two weeks later, the patient delivered uneventfully. The patient was followed up at one month and 3 month and demonstrated restitution of normal occlusion, mouth opening and lower facial height. This article aims at analyzing the contemporary principles in management of maxillofacial trauma in a pregnant woman and clarifying the common misconceptions.

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Introduction

The incidence of trauma in pregnant women is approximately 5%, a majority of which results from motor vehicle accidents.^{1,2} The other common etiological factors cited in the literature are fall and domestic violence.¹ Assault, gunshots and stab injuries constitute the least frequent causes.³ Maxillofacial injuries in a pregnant woman deserve special attention because of two major reasons: (1) their management involves consideration of two lives—the mother and the foetus and (2) they reflect an alarming 6.6%–30%^{3,4} increase in physical abuse which results in 5% incidence of foetal death.² Decision towards interventional procedures in a pregnant woman requires careful assessment of numerous factors aimed at the wellbeing of the mother as well as the foetus.⁵

Annually, 2% of pregnant women undergo surgical procedures for various non-obstetric reasons such as management of malignancies, acute appendicitis and trauma. However, reports of interventional procedures to treat maxillofacial fractures in a gravid

woman are rare.⁶ Current reports are predominantly general reviews which do not present comprehensive treatment guidelines.

This article aims at analyzing the contemporary principles in management of maxillofacial trauma in a pregnant woman and clarifying the common misconceptions, along with a case report. The article also attempts to provide recommendations regarding the following clinical queries concerning trauma in pregnancy: (1) whether to intervene or not, (2) role of imaging, (3) safety of local anaesthesia (LA), (4) conservative vs. open reduction & internal fixation (ORIF), (5) need for multidisciplinary approach, (6) treatment objectives, (7) procedure under general anaesthesia (GA) or LA, and (8) perioperative medication.

Case report

A 30-year-old female patient (Fig. 1) reported to the department of oral and maxillofacial surgery, with chief complaints of difficulty in opening the mouth and pain in the pre-auricular region, for the past 10 days. The pain was dull aching in nature, radiating to both the ears and did not subside with medication. The patient was pregnant in her 3rd trimester (32 weeks of gestation period) with no systemic complications. The patient revealed a history of fall

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Fig. 1. Frontal view demonstrating increased lower facial height.

from a motorbike after which she was taken to a nearby maxillofacial facility where she was diagnosed with bilateral condylar fracture. She was treated with open dressing for her facial abrasions and suturing for a chin laceration but was advised “nil treatment” for the fracture, in view of her pregnant status.

Examination of the patient at our centre revealed a sutured laceration at the chin with restricted mouth opening of 18 mm. Temporomandibular joint examination demonstrated feeble movements on the right side, while no movements were elicited on the left side. Tenderness was present in both the joints. Intraoral examination revealed anterior open bite and bilateral posterior gagging of occlusion (Fig. 2). The patient was partially edentulous with missing 11, 21, 22, 24 and 46. Extrusion of 13 was observed. Based on the above clinical features, a provisional diagnosis of bilateral condyle fracture was made. Orthopantomogram demonstrated fracture of the right and left condyle at neck level (Fig. 3).

Considering the gravid status of the patient, a conservative treatment plan aimed at improving the mouth opening and occlusion was made. The patient was positioned in the lateral decubitus position with a back rest. Orthodontic brackets were bonded onto the existing teeth and inter maxillary fixation (IMF) was achieved with elastics (Fig. 4). After an hour, the patient demonstrated reasonable occlusion and reduced pain in the



Fig. 2. Anterior open bite.

temporomandibular region. Elastics were removed 10 days later to facilitate normal nutrition. Physiotherapy in the form of mouth opening using ice cream sticks and lateral jaw movements was advised 10 min twice a day for one month to facilitate functional remodelling of condyle.

Two weeks later, the patient delivered uneventfully. The patient was reviewed after a month and again after two months, during which she demonstrated restitution of her normal occlusion, mouth opening and lower facial height (Fig. 5). Fig. 6 demonstrates the orthopantomogram of the patient at two months after trauma.

Discussion

The management of maxillofacial injuries in a pregnant woman raises numerous queries related to investigations, anaesthesia and surgical management. The traditional concepts of managing maxillofacial trauma in a pregnant woman have been inclined towards conservative treatment. This article aims at discussing the evolution of contemporary management principles and their rationale.

Imaging in pregnant woman

Assessment of trauma by imaging is the first step in management of fracture. Necessary imaging must not be neglected with the misconception that it may injure the foetus. Even in a pregnant patient who reports with obvious maxillofacial trauma alone, the objectives of imaging must include assessment of the obvious site of injury (maxillofacial region) as well as the abdomen to ensure safety of the foetus.⁷ It is also mandatory to pay attention to the internal organs of the abdomen. The clinical implications of the above statement have been explained by Aramanadka et al.⁸ Their study compared injury in pregnant vs. non-pregnant women and demonstrated that physiological changes in pregnant women displace various internal organs such as the spleen, liver, bowels and bladder superiorly, making them more prone to injury.

Any examination that does not involve direct exposure to the maternal abdomen, e.g., head computed tomogram (CT) or chest CT, should be performed without fear of radiation affecting the foetus.⁹ Routine conventional radiographs as well as CT may be taken with adequate precautions including abdomen shielding with lead aprons. Exposure during CT imaging may also be reduced by limiting the number of CT slices or restricting the area of focus.²

The other modalities of imaging could also be exploited to minimise radiation exposure. Focussed assessment using sonography in trauma is a rapid, non-invasive and effective method with minimal exposure hazards to examine maxillofacial trauma in a pregnant woman. It also helps in detecting peritoneal fluid in pregnant women with history of blunt abdominal trauma, with 83% sensitivity.⁷

Choice of anaesthesia: GA or LA?

GA for a gravid woman is generally not recommended in the first and third trimester because of potential foetal injury due to anaesthetic anoxia.¹⁰ The first trimester of pregnancy also poses the risk of abortion and teratogenicity due to drugs used for GA.¹¹ Further, GA poses technical difficulties involving intubation procedures due to the complicated anatomic and physiological changes in pregnancy: (1) the friable characteristic of oropharyngeal mucosa predisposing it to bleeding during intubation, (2) exaggerated gastroesophageal reflex leading to risk of aspiration, and (3) reduced tone of the lower oesophageal sphincter leading to delay in gastric emptying.



Fig. 3. Orthopantomogram demonstrating bilateral condyle fracture.

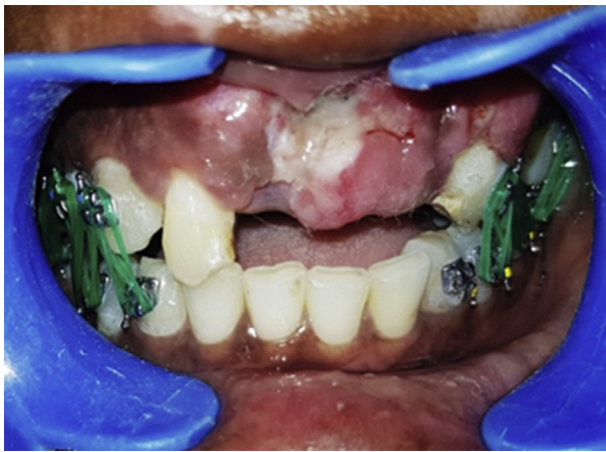


Fig. 4. Occlusion with elastics.

Nevertheless, surgery under GA in a pregnant woman for obstetric reasons has been well justified and accepted in definite clinical indications.¹² In contrast, GA for non-obstetric reasons including maxillofacial trauma remains controversial. However literature is abundant with reports of surgical procedures under GA for non-obstetric indications such as fractures involving pelvis, acetabulum, ankle, clavicle, rib and spinal cord.^{13–17} Surprisingly very few cases of maxillofacial trauma, managed under GA, are reported.

The following guidelines applicable to general non-obstetric cases may be followed for management of maxillofacial trauma: (1) A pregnant woman can be taken up for non-obstetric, surgical management under GA, when necessary. (2) Elective surgeries can be delayed until postpartum. (3) The decision to perform essential surgery varies according to the trimester involved. In the first trimester, surgery may be performed when the risk to the mother is more than minimal. Absence or minimal risk to the mother mandates postponement of surgery to midpregnancy. Patients in the second or third trimester must be treated as for an emergency surgery. (4) Emergency surgeries are performed immediately by a multidisciplinary approach, with adequate uterine and foetal monitoring. (5) In the event of a maternal cardiac pulmonary arrest, a perimortem caesarean section is indicated to extract the foetus within 4 min, as per the 4 min rule.¹⁸ In a pregnant patient with post traumatic cardiac arrest, tracheal intubation was done and a caesarean section was performed to deliver the foetus.¹⁹

Safety of LA in pregnancy

LA is the method of choice for any surgical intervention during the first and third trimester, to avoid exposure to volatile anaesthetic agents which may be teratogenic. LA may be safely used in pregnant woman except in patients with associated systemic disorders such as Christmas disease, or Von Willebrand's disease and haemophilia because of risks of haemorrhage.¹⁰ LA agents cross the placental barrier, but foetal toxicity has not been demonstrated even at doses above the maximum recommended dose in humans, according to Donaldson et al.²⁰

The safety of LA in a pregnant patient depends on the type and dosage of LA agent used. The following measures ensure safety to the pregnant women as well as to the foetus:

Type of LA agent

LA agents which are considered safe in pregnancy belong to pregnancy risk category B.²¹ The commonly used LA agent lignocaine falls under category B of Food & Drug Administration and hence is safer to use in all three trimesters of pregnancy.²² At normal clinical doses Bupivacaine has lowest foetal to maternal ratio as compared to Lidocaine and does not cross the placental barrier and hence extensively used in the field of obstetrics.²³ However, Bupivacaine belongs to category C which poses risk to the foetus. Further, Bupivacaine at toxic doses can precipitate cardiac arrest and hence Bupivacaine in high concentration is not recommended as a LA agent for dental procedures in pregnant women.²⁴

Dose of LA

Pregnancy induces physiological changes which result in increased vascular permeability and volume which makes the patient prone to overdose of LA. It has also been found that pregnancy is associated with increased unbound form of LA molecules which predisposes to foetal toxicity. Reducing the dose of LA agent is considered a safe measure.²⁵ The maximum dose of 2% lignocaine with 1: 100,000 epinephrine is limited to 4.4 mg/kg in a pregnant woman in contrast to 7.7 mg/kg in a non-pregnant woman.²¹

Supplemental techniques

The use of nitrous oxide sedation should be avoided, whenever possible, during the first trimester. Even during the second & third trimester, its use is limited to supplementing anaesthesia for non-deferrable clinical conditions where local anaesthesia is inadequate.²⁶ Prior consultation with obstetrician is mandatory. Safety during procedure is ensured by administering with minimum of



Fig. 5. Two months after trauma. (A) Occlusion; (B) Mouth opening; (C) Frontal view demonstrating normal lower facial height.

50% of oxygen and restricting the duration of the procedure to 30 min.

Use of vasoconstrictor

Requirement of large doses necessitate usage of LA solution with adrenaline in low concentrations. From the foetal aspect, Epinephrine is considered a safer vasoconstrictor in comparison to Levonordefrine.²¹ However when Epinephrine is injected intravascularly, it may result in vasoconstriction of the uterine artery and reduced blood flow to the uterus.

Patient position

From the 20th week of gestation, the aortocaval compression predisposes 30% of women²⁷ to supine hypotensive syndrome and decreases uterine blood flow which may affect the foetus. A woman positioned supine demonstrates bradycardia. In the third trimester, signs of shock are demonstrated by 10% of pregnant women.²⁸ Hence it is advised to position patients in the second and third trimester in the left lateral decubitus position with a wedge under the right hip that provides a tilt of 15°. In the presence of a large uterus, elevation of 30° may be needed, usually with a pillow or folded blanket. Rarely right uterine displacement is necessary to relieve the aortocaval compression.²¹ Sometimes manual displacement of the uterus may be necessary to manage the supine hypotension syndrome.²⁹

Conservative vs. ORIF

Most of the articles in English literature which discuss the management of maxillofacial trauma in pregnant women favour conservative management due to limitations in use of anaesthetic agents and the potential ill effects of surgical procedures on the systemic status of the patient as well as the foetus.⁸

Intermaxillary fixation is the most commonly used conservative method of fracture management.^{30,31} However this may compromise anatomic reduction. More importantly, it affects the masticatory function which directly influences the nutrition of the mother as well as the foetus. Further it predisposes the patient to risk of aspiration.

Some authors have advocated ORIF of fractures under LA.³⁰ But these cases have been restricted to fractures of the anterior mandible. Aramanadka et al.⁸ treated a patient in second trimester for mandibular parasymphysis fracture under LA.

Very few cases have been managed under GA. Zhang et al.¹³ reported ORIF of a superiorly dislocated condyle with associated parasymphysis fracture, in a pregnant woman (20 weeks of gestation) under GA. The fracture was approached through preauricular and vestibular incisions to fix the condyle and the parasymphysis

fracture respectively, by mini plates. A position paper published by Neff et al.³¹ stated that 46.3% of the audience and 45.5% of the experts favoured internal fixation for a pregnant woman in second trimester with clinical presentation of bilateral condylar fracture at the base and neck of the condyle.

Rigid fixation of maxillofacial fractures is advised to negate the need for maxillo-mandibular fixation. This is essential to ensure proper nutrition to the mother as well as the foetus. Further, it avoids the risk of aspiration in pregnant woman who are already prone to regurgitation due to reduced tone of the lower oesophageal sphincter.^{6,21}

Need for multidisciplinary approach

Management of craniofacial trauma in a pregnant woman must constitute a multidisciplinary approach involving a maxillofacial surgeon, neuro-surgeon, obstetrician, orthopaedic surgeon, paediatrician, anaesthetist and a radiologist. Irrespective of the type of anaesthesia used (LA or GA), management of trauma in a pregnant patient in her late 2nd or 3rd trimester should be managed under the supervision of senior obstetrician, anaesthetist, midwife and a paediatrician, if delivery is anticipated.^{13,29}

The advanced trauma life support sequence for a pregnant woman includes the following: (1) ideal patient positioning, (2) primary survey, (3) evaluation of foetal status, (4) secondary survey, and (5) definitive management.²⁹ After 20 weeks of gestation, the ideal patient position is left lateral to negate the complications due to aortocaval compression. A routine primary survey should be carried out to identify and manage life threatening conditions. When necessary, resuscitation drugs may be administered according to life support guide lines, in the same doses as for a non-pregnant patient.²⁹ While performing cardio pulmonary resuscitation, the objectives are to improve the survival chances of the mother as well as the foetus. In the event of maternal cardiac arrest, caesarean section is indicated for viable pregnancies (≥ 24 weeks) that would resuscitate the mother and save the foetus.^{7,32}

Foetal assessment is of utmost importance as direct or indirect trauma to the foetus poses serious risks to foetal life. The assessment of the foetal heart rate may be done effectively by using a hand held Doppler or a Pinard stethoscope. Ultrasound may be used to identify the foetal status, placentation and signs of bleeding or trauma to the pelvis. Cardiocotography is ideal to record the uterine activity.²⁹ Secondary survey and definitive treatment should follow the usual protocol. The need for a neurosurgical team is important: to distract and reduce the superiorly dislocated condyle and to manage any cerebro spinal fluid leak or haemorrhage by craniotomy.¹³



Fig. 6. Orthopantomogram at two months after trauma.

Assessment of lab tests

The interpretation of biochemical tests in a pregnant woman deserves special mention because of the variation in normal values as compared to a non-pregnant woman. The common abnormalities which are considered normal in a pregnant woman are leucocytosis, increased fibrin values, increased alkaline phosphatase, decreased partial pressure of carbon dioxide and serum creatinine.⁷ Similarly, presence of D-dimer is common in a pregnant woman.⁷ The physiology behind these changes have been explained in detail by Flynn et al.² The biochemical profile in a pregnant woman thus needs careful assessment and clinical correlation.

Medication during pregnancy

Analgesics

The universally considered primary choice of analgesic in a pregnant woman is Acetaminophen. It falls under the category B which is labelled safe for gravid women.²¹ The general group of non steroidal anti-inflammatory drugs (NSAIDs) is avoided because of their inhibitory effect on synthesis of prostaglandins which is vital for endometrial integrity. During the last trimester, NSAIDs have also been associated with premature closure of ductus arteriosus²¹ and prolongation of the gravid status. When absolutely needed, NSAIDs may be used during the second trimester alone, which also must be limited to 48–72 h.

Steroids

Administration of antenatal steroids has been found to be safe. Corticosteroids have an important role in reduction of neonatal morbidity. A course of corticosteroid therapy to pregnant women at risk of pre-term delivery is validated by American College of Obstetricians and Gynaecologists Committee on Obstetric Practice.

Antibiotics

A healthy pregnant woman with no compromise in systemic status may be given antibiotics belonging to category B. The commonly used antibiotics in the peri-operative period must be judiciously used in appropriate dose and frequency. Penicillin V, Amoxicillin, Amoxicillin with clavulanic acid may be required in higher dose or increased frequency when prescribed in the second and third trimesters.⁷ This may be related to the altered physiology and biodynamics of body fluids in pregnancy which results in reduced peak serum concentration and lesser half-life of the drugs. However pharmacokinetics of Cephalexin and Clindamycin are not

altered by pregnancy.⁷ The administration of Metronidazole has also been found to be associated with less risk of teratogenicity.³³

Safety precautions for pregnant women

Traffic safety for pregnant women includes proper positioning of the seatbelt to prevent rupture of uterus and foetal death. The seatbelt must be positioned as inferior as possible, stretching/ extending across the thighs and below the most prominent portion of the abdomen. The shoulder strap must be shifted to the side of the uterus, while resting on the midpoint of the clavicle and lying between the breasts. Airbags need not be deactivated while seating a pregnant woman. However, a minimum distance of 10 inches must be maintained between the airbag cover and the pregnant woman.³⁴

Analysis of the case report

This is the only article in English literature which discusses the management of condyle fracture in a pregnant woman in last week of third trimester. This case report demonstrates a simple yet effective technique of managing bilateral condylar fracture by IMF with resultant functional occlusion and normal mouth opening.

The advantages of IMF using orthodontic brackets with elastics were many: (1) No LA solution was injected into the tissues and therefore there were no concerns regarding systemic toxicity due to LA agents. (2) Trauma to the tissues due to LA injections or wiring required for conventional arch bar fixation is completely negated. There was no injury to the gingival tissues which is very important in pregnant women because gingiva is more prone to bleeding and inflammation due to hormonal changes. (3) Time taken for the IMF was relatively less. (4) No bleeding was encountered and hence it is ideal even in patients with bleeding disorders. (5) Intra-oral accumulation of food debris was minimal due to the absence of wires which secure conventional arch bars. (6) IMF with elastics was more effective and safer as compared to wires because elastics help to train the mandible to functional occlusion and are easier to remove. The elastics may be cut quickly by patients themselves, at emergency situations such as vomiting. (7) The patient was advised a rigorous schedule of physiotherapy involving jaw movements (jaw opening using ice cream sticks and lateral excursions) after the period of IMF, which is very vital to restitution of normal jaw movements and prevention of ankylosis.

However use of orthodontic brackets does not provide cross arch stability or splinting action which may be needed in the

presence of anterior mandible fractures along with bilateral condyle fracture. In such cases, bondable arch bars are ideal alternatives.³⁵

Treatment options including ORIF of fractured condyles must be given to the patient after carefully explaining the advantages and disadvantages of both the methods. Choosing between conservative and surgical management depends on the clinical emergency and sometimes, prerogative of the patient. A patient opting for ORIF of fracture under GA in the third trimester must be operated on in a facility with proper gynaecological and paediatric support. Our patient had complete restitution of normal occlusion and relief of pain within 2 days and chose to get the fractures fixed by ORIF after delivery. Restoring the nutritional status of a pregnant woman is of utmost importance as the nutrition status of the mother directly influences the nutrition status of the foetus.

Conclusion

Pregnancy must be ruled out in every woman of reproductive age who reports for management of maxillofacial trauma. Adequate precautions must be taken and care given before, during and after investigations and treatment procedures. Surgical objectives in a pregnant woman must be aimed at (1) protecting the mother as well as the foetus and (2) immediate restoration of vital functions such as breathing and mastication which directly influence the nutritional status of the foetus.

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Ethical Statement

Informed consent has been obtained.

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Declaration of Competing Interest

The authors declared no competing interest.

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