Intraosseous Jaw Changes of A Rhabdomyosarcoma Patient Assessed with CBCT

SY Lin*, HC Chan *, J Hu**, E Benavides**
*Vine Pediatric Dental Clinic
* * University of Michigan School of Dentistry, Ann Arbor, Michigan 48109

ABSTRACT

Purpose: To evaluate intraosseous jaw changes in a patient with embryonal rhabdomyosarcoma after chemoradiation therapy using cone beam computed tomography (CBCT).
Methods: A 12-year and 10-month old African-American male with history of embryonal rhabdomyosarcoma (RMS) involving the left trigeminal nerve presented to the Pediatric Clinic at School of Dentistry for new patient examination. RMS was diagnosed in January 2000. Radiation- and chemotherapies were completed in March 2002. Clinically, gingival hyperplasia with erythema was present on the maxillary left quadrant. Panoramic radiographs revealed multiple, bilateral, well-defined radiolucent-radiopaque lesions in the mandible. Considering the patient's medical history, CBCT was recommended to further evaluate these lesions in order to rule out recurrence or metastasis.
Results: CBCT revealed multiple, mixed-density lesions throughout the maxilla and mandible which showed slow-growing, benign radiographic features and appeared to be fibro-osseous in nature. These lesions could be sequelae of chemo-and/or radiation therapy. The fact that the lesions are bilateral favors secondary effects from chemo- rather than radiation therapy. After assessing potential risk for osteoradionecrosis, biopsy was recommended to rule out RMS recurrence. If the calculated risk would have been high, radiographic follow-up every 3-6 months would have been recommended.
Conclusions: There is a series of immediate and long-term dento-maxillofacial defects after chemoradiation therapy to the head and neck. The type and severity of abnormalities are related to the age of patient at the time of diagnosis, the type of treatment, and the therapeutic dose. Multidisciplinary approach and periodical monitoring of secondary therapeutical effects are necessary in addition to prevention regimen.

INTRODUCTION

Rhabdomyosarcoma (RMS), the most common soft tissue sarcoma in children, comprises neoplastic mesenchymal cells with varying degrees of striated muscle cell differentiation. Forty percent of RMS are located in the head and neck region. The possible trigger mechanisms for RMS include genetic factors, previous radiation treatment, and virus.

Classification of RMS is according to the histological appearance. The latest classification system is composed of subtypes with embryonal, botryoid, alveolar, spinal cell, anaplastic, and alveolar types. The histological diagnosis has its significance for predicting prognosis. The botryoid subtype has the best prognosis and occurs at very young age. Embryonal RMS, with an intermediate prognosis, occurs in an intermediated age range. The alveolar and anaplastic subtypes have the worst prognosis, and occur in older children. Other predictors for prognosis include the stages of the disease at diagnosis, anatomic localization, and degree of tumor cell anaplasia.

Intergroup Rhabdomyosarcoma Study Group (now the Soft Tissue Sarcoma Committee of the Children's Oncology Group) recommend multimodality treatment involving chemotherapy, surgery, and radiotherapy for RMS and can achieve 2-year survival rates of up to 80% at all sites. Complete surgical resection provides the best prognosis and allows the avoidance of radiotherapy. However, not all sites are indicated for surgery alone. Chemoradiation therapy is performed to prevent metastases and to eliminate gross or microscopic disease. The complications caused by chemo- and radiation therapies include dental, craniofacial, neuroendocrine, thyroid, and cognitive sequelae.

Cone-beam computed tomography (CBCT) has been designed for imaging hard tissue of the maxillofacial region. The advantages of high diagnostic quality, short scanning times (10~70 seconds), 3-dimentional representation, and the radiation dosages lower than those of conventional CT scans increase availability of CBCT technology in clinical dental practice.

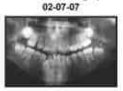
CASE REPORT

A 12-year and 10-month old African-American male was seen in the Pediatric Clinic at the University of Michigan School of Dentistry for rampant caries in October 2006. The patient was diagnosed with embryonal rhabdomyosarcoma (RMS) involving the left trigeminal nerve and extending into the parameningeal area of the head in January,2000. He was enrolled in CCG protocol D9803 and treated with a combination of chemo- and radiation therapies. He was treated with vincristine, cytoxan, and actinomycin and received a total of 8640 rads (5040 to the tumor bed and 3600 to the left brain, left margin). The chemoradiation therapy was completed on March 20,2002 and then he was at 6 months intervals follow up and did not take any medication for more than 2 years.

Clinical findings exhibited asymmetrical facial profile and radiation caries, as well as gingival hyperplasia with erythema on the maxillary left quadrant. The soft tissue biopsy revealed that it was erythematous gingivitis probably related to radiation therapies to the left side. Panoramic radiograph revealed blunted root shape on the incisors, canines, premolars and root agenesis on the second mandibular molars. The dental changes are more likely complications from chemo- and radiation therapies. Radiographs also showed multiple, bilateral, well-defined radiolucent-radiopaque lesions in the mandible. Considering the patient's medical history, CBCT was recommended to further evaluate these lesions in order to rule out recurrence or metastasis.

RESULTS

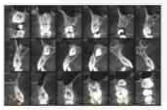
Extra-oral Photographs
02-07-07



02-07-07

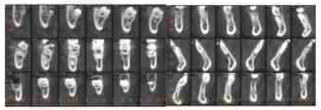
1. Radiolucencies with corticated margin on the right and left molar/premolar area in the mandible
2. Asymmetrical mandible

Maxilla



1. A poorly-defined mixed-density lesion is noted in the periapical area of teeth #4 and 5
2. Tooth #11(cross-section #96) showed mixed density lesion
3. Mild thickening of the mucosa of the left maxillary sinus is noted on the cross-sections #92-109
4. The bone density throughout the maxilla is heterogeneous

Mandible



1. Multiple mixed density lesions are noted throughout the mandible in the areas of teeth #31(cross-sections #45-52), #30-29(cross-sections #55-70), #28, involving the right mental foramen (cross-sections #73-76), #23-22(cross-sections #84-97), #20-21, involving the left mental foramen (cross-sections #112-125); superior to this lesion, there is a smaller lesion toward the buccal aspect of the mandible (cross-sections #115-121)
2. The lesions located in the areas of the mental foramina and the anterior mandible are causing expansion, thinning, and possible perforation in some areas of the cortices of the mandible (cross-sections #76,97,112,115,118,121)

DISCUSSION

Oral cavity involvement of RMS is uncommon. The tongue, soft palate, hard palate, and buccal mucosa are the sites of predilection. RMS do frequently metastasize, especially in the head and neck region. Osteonecrosis and osteoradionecrosis of jaw are common complications after chemo- and radiation therapies. In the present case report, multiple mixed density lesions throughout the maxilla and mandible were found and appeared to be fibro-osseous in nature. These lesions are bilateral favoring secondary effects from chemo- rather than radiation therapy. Although the lesions appear slow-growing and present benign features, considering the patient's medical history, it is imperative to further evaluate these lesions in order to rule out recurrence or metastasis. Biopsy is suggested to confirm the diagnosis if calculated osteoradionecrosis risk is low. If calculated osteoradionecrosis risk is high, radiographic follow up every 3-6 months is recommended.

CONCLUSIONS

Chemo- and radiation therapies can cause bony changes. Multidisciplinary approach and periodical monitoring of secondary therapeutical effects are necessary in addition to prevention regimen and rule out secondary tumor.

Maternal BANA Test Status and Preterm Birth

HC Chan *, JF Bai * *, CT Wu#, KB Welch * * *, WJ Loesche * * *
* Vine Pediatric Dental Clinic
* * San Ann Hospital; #Show Chawn Memorial Hospital
* * * University of Michigan School of Dentistry, Ann Arbor, Michigan 48109

葡萄藤兒童牙科 Vine Pediatric Dentistry

INTRODUCTION

- There are many theories regarding the etiology of preterm birth (PB).
- ***Maternal infections*** is one of the causes for preterm delivery.
- ***Periodontal disease*** (PD), as a source of subclinical and persistent infection, has been identified as a risk factor for medical condition. Therefore, maternal PD may play an important role for adverse pregnancy outcomes.
- The link between maternal PD and adverse pregnancy outcomes is due to its ***infection*** and ***inflammation nature***.
- There are conflicting opinions as to whether maternal PD is a risk factor for adverse pregnancy outcomes.

OBJECTIVE

- To address the link between periodontal pathogens measured with the BANA test (N-benzoyl-DL-arginine-2-naphthylamide) and preterm birth (PB) (<37th week gestation)

METHODS

Study Design

Pregnant women prenatal visit in the OBGYN department → Second (13~15 to 25~28 weeks) Third (25~28 to 37~40 weeks) trimester

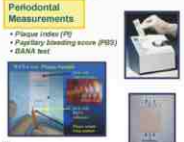
Questionnaire and *periodontal measurements*

Questionnaire

- *Maternal demographics*: Age, ethnicity, occupational and educational level, medical history
- *Previous pregnancy history*: History of previous pregnancy, preterm birth, LBW infant, abortion
- *Current pregnancy status*: Genitourinary infection, time of first prenatal visit, frequency of prenatal visit, complications during pregnancy
- *Risk factors*: pre-pregnancy BMI, betel-nut chewing, smoking, alcohol drinking, antibiotic history
- *Dental history*: Oral hygiene care, frequency of visiting the dentist, history of periodontal disease

Periodontal Measurements

- *Plaque index (PI)*
- *Papillary bleeding score (PBS)*
- *BANA test*



Evaluate pregnancy outcome *Preterm Birth*

- **Patient Population**
  This is a prospective study which was conducted in Obstetric and Gynecological clinic in Show Chawn Memorial Hospital and San Ann Hospital, Changhua, Taiwan.
- **Inclusion Criteria**
  Pregnant women, single gestation, in the second trimester (13~16 weeks to 25~28 weeks)
- **Exclusion Criteria**
  Multiple gestation and artificial fertilize treatment women

RESULTS

Demographic Characteristics

Variables		Pregnancy Outcome Normal n(%)	Preterm birth n(%)	p-value (Fisher's Exact test)
Age	< 18	3(100.0%)	0(0.0%)	
	18~37	267(93.0%)	20(7.0%)	
	>37	6(88.9%)	1(11.1%)	.590
Ethnicity	Taiwanese	267(93.7%)	18(6.3%)	
	Non-Taiwanese	11(78.6%)	3(21.4%)	.066
Mother Occupation	Housewife	9(94.2%)	6(5.8%)	
	Non-housewife	180(92.3%)	15(7.7%)	.639
Father Occupation	Laborers	118(94.4%)	7(5.6%)	
	Non-laborers	160(92.0%)	14(8.0%)	.496
Mother Education	≤ Senior high school	147(91.9%)	13(8.1%)	
	> Senior high school	131(94.2%)	8(5.8%)	.500
Father Education	≤ Senior high school	156(92.9%)	12(7.1%)	
	> Senior high school	122(93.1%)	9(6.9%)	> 999
Previous Medical History	Healthy	257(93.1%)	19(6.9%)	
	Medical condition	21(91.3%)	2(8.7%)	.670

- **Risk Factors**
  There was no significant relationship between preterm birth and risk factors, which included pre-pregnancy BMI, the habit of smoking, alcohol consumption during pregnancy, antibiotic history in the second and third trimester, and the time of first prenatal care. (p=0.358, >0.999, >0.999, 0.454, 0.737, 0.126 respectively)
- **Dental History**
  There was no relationship between dental history i.e. oral hygiene care, frequency of visiting the dentist, history of periodontal disease and preterm birth. (p=0.379, 0.517, 0.632 respectively)
- **Previous Pregnancy History**
  Fisher's exact test showed a significant relationship between preterm birth and previous preterm birth and previous low birthweight history. (p=0.044, 0.034 respectively) There was no relationship between preterm birth and maternal first pregnancy, pregnancy frequency, spontaneous abortion and artificial abortion. (p=0.999, 0.782, 0.145, and >0.999 respectively)

Complications During Pregnancies

Variables		Pregnancy Outcome Normal n(%)	Preterm birth n(%)	p-value (Fisher's Exact test)
URI[1]	No	122(90.4%)	13(9.6%)	
	Yes	156(95.1%)	8(4.9%)	.118
GUI[2]	No	207(93.7%)	14(6.3%)	
	Yes	71(91.0%)	7(9.0%)	.444
<28 weeks hemorrhage	No	218(92.8%)	17(7.2%)	
	Yes	60(93.9%)	4(6.3%)	> .999
Premature uterus contraction	No	245(94.6%)	14(5.4%)	
	Yes	33(82.5%)	7(17.5%)	.013*
PPROM[3]	No	264(93.3%)	13(4.7%)	
	Yes	14(63.6%)	8(36.4%)	<.001**
APH[4]	No	269(94.7%)	15(5.3%)	
	Yes	9(60.0%)	6(40.0%)	<.001**
PIH[5]	No	272(92.8%)	21(7.2%)	
	Yes	6(100.0%)	0(0.0%)	> .999
PD[6]	No	278(94.2%)	17(5.8%)	
	Yes	2(33.3%)	4(66.7%)	<.001**
PIDM[7]	No	274(92.9%)	21(7.1%)	
	Yes	4(100.0%)	0(0.0%)	> .999

*p<0.05, **p<0.001
1. URI=Upper respiratory infection; 2. GUI=Genitourinary infection; 3. PPROM= Preterm premature rupture of membrane; 4. APH=Antepartum hemorrhage; 5. PIH=Pregnancy induced hypertension; 6. PF=Placenta previa; 7. PIDM=Pregnancy induced diabetes mellitus

Comparing means of continuous variables for preterm birth and normal term births

Time Period	Variables	Normal Mean (s.d.)	Preterm Birth Mean (s.d.)	t	df	p-value
Pre-pregnancy	BMI	21.06 (3.55)	20.35(2.40)	.929	297	.354
2nd trimester	PI	.65(.64)	.89(.57)	1.696	297	.091
	PBS	1.67(.81)	1.74(.72)	.377	297	.706
	BANA	1.71(.81)	1.81(.70)	.729	289	.466
3rd trimester	PI	.48(.61)	.53(.46)	1.063	274	.990
	PBS	1.96(.83)	1.96(.97)	.013	274	.990
	BANA	1.75(.80)	1.92(.67)	1.216	274	.225
During pregnancy	Weight gain (Kg)	14.58(4.02)	11.46(3.59)	3.388	297	.001*

*p<.001

Periodontal Measurements

Variables		Second Trimester Pregnancy Outcome Normal n(%)	Preterm Birth n(%)	p-value (Fisher's exact test)	Third Trimester Pregnancy Outcome Normal n(%)	Preterm Birth n(%)	p-value (Fisher's exact test)
Oral hygiene	Good or fair[a]	229(94.1%)	14(5.9%)		211(93.0%)	16(7.0%)	
	Poor	53(88.3%)	7(11.7%)	.153	46(93.9%)	3(6.1%)	> .999
Gingivitis[b]	No	96(95.0%)	5(5.0%)		56(93.3%)	3(6.7%)	
	Yes	182(91.9%)	16(8.1%)	.473	201(93.1%)	15(6.9%)	> .999
Infected BANA plaque samples	No	113(94.2%)	7(5.8%)		92(96.8%)	3(3.2%)	
	Yes[c]	157(91.8%)	14(8.2%)	.496	165(91.2%)	16(8.8%)	.065

a. Good or fair oral hygiene was defined as the plaque index is 2 or greater than 2 in less 50% sites
b. Gingivitis indicates that two or more sites had bleeding
c. Infected BANA means BANA positive or weak positive
d. Infected BANA plaque samples means two or more sites were BANA positive or weak positive

Significant Predictors of Preterm Birth Based on Logistic Regression Analysis

Variables			X^2	df	Sig	Odds ratio (OR)	95% C.I. for OR Lower	Upper
Ethnicity	Step1[a]	Non-Taiwanese	2.997	1	.083	4.477	.820	24.435
History of previous PB and LBW		Previous preterm birth	.061	1	.805	.689	.036	13.232
		Previous LBW	2.005	1	.157	8.256	.444	153.361
Medical complications during pregnancy		Weight gain	5.706	1	.017*	.793	.656	.959
		Preterm uterus contraction	3.913	1	.048*	3.793	1.012	14.211
		Antepartum hemorrhage	1.766	1	.184	3.526	.550	22.622
		Placenta previa	4.897	1	.027*	88.163	1.668	4658.869
		PPROM	20.266	1	<0.001**	22.674	5.826	88.247
Dental/periodontal environments		Infected BANA plaque samples[a]	4.773	1	.029*	5.786	1.198	27.950
		Constant	3.248	1	.071	.085		

a. Variables entered on step 1: previous preterm birth, previous LBW, infected BANA plaque samples, weight gain during pregnancy, premature uterus contraction, antepartum hemorrhage, placenta previa, PPROM, non-Taiwanese
b. Infected BANA plaques samples means two or more sites were BANA positive or weak positive in third trimester
* p< 0.05
** P< 0.001

- Infected BANA plaque samples in the third trimester, weight gain during pregnancy, preterm uterus contraction, placenta previa, and preterm premature rupture of membrane were strong risk predictors for preterm birth outcome in Taiwanese pregnant women after controlling other explanatory risk factors.
- Gingivitis did not correlate with preterm birth.

Conclusions

- Among dental / periodontal parameters, only infected BANA plaque samples in the 3rd trimester was an independent predictor of preterm birth.