Three Dimensional Analysis of Hemimetameric Segmental Shift

MEIJO HOSPITAL
ORTHOPAEDICS & SPINE
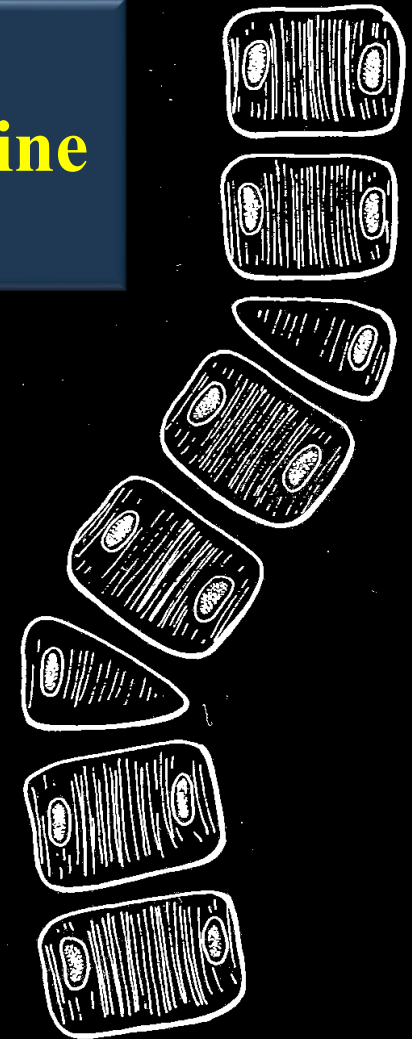
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Classification of Congenital Scoliosis using 3D-CT (Kawakami et al, Spine, 2009)

Discordant Anomaly

Mismatch among the anterior and posterior segments

3D-CT is indispensable to analyze the morphology of congenital scoliosis

Purpose

To three dimensionally analyze the morphology and clinical features of HMMS

Materials and Methods

Congenital scoliosis（1998-2011）　n=312

　　　　　　　　　　HMMS　n=22 (7.1%)

22 cases（10 males, 12 females）

Age at the first visit：　　　6 years 11 months

　　　　　　　　　　（4 months 〜18 y.o.）

Imaged using 3D-CT: **20 cases**

　　　　　　(Age at 3D-CT: 9 y.o. , 2〜21 y.o.）

20 patients were evaluated by analyzing three-dimensional morphology according to Kawakami's classification, particularly paying attention to the posterior structure of HVs.

Number and Location of Hemivertebrae in 20 Patient

Number of HVs	n=2 (13 cases)													n=3 (5 pts.)					n=4 (2 pts.)	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
T1																	L		R	
T2												L								
T3											R									R
T4																R				
T5																R		L		
T6																				L
T7														L		R				
T8											R				L	L	R	L		R
T9																				
T10									L			L	R	R	L				R	L
T11	R																			
T12					R	L	R	R			L									
T13															R				R	
L1									R					L		R				
L2	L											L								
L3						R	L											L		
L4		R	L	L							R									
L5					L						L									
L6		L	R	R																

Patients with 2 hemivertebra were most common to have hemivertebra in the thoracolumbar and lumbar spine, while patients with 3 or more hemivertebra was in the thoracic spine.

Case 1. 6 y.o. Male

Lt T11; FSHV, Rt L3; FSHV

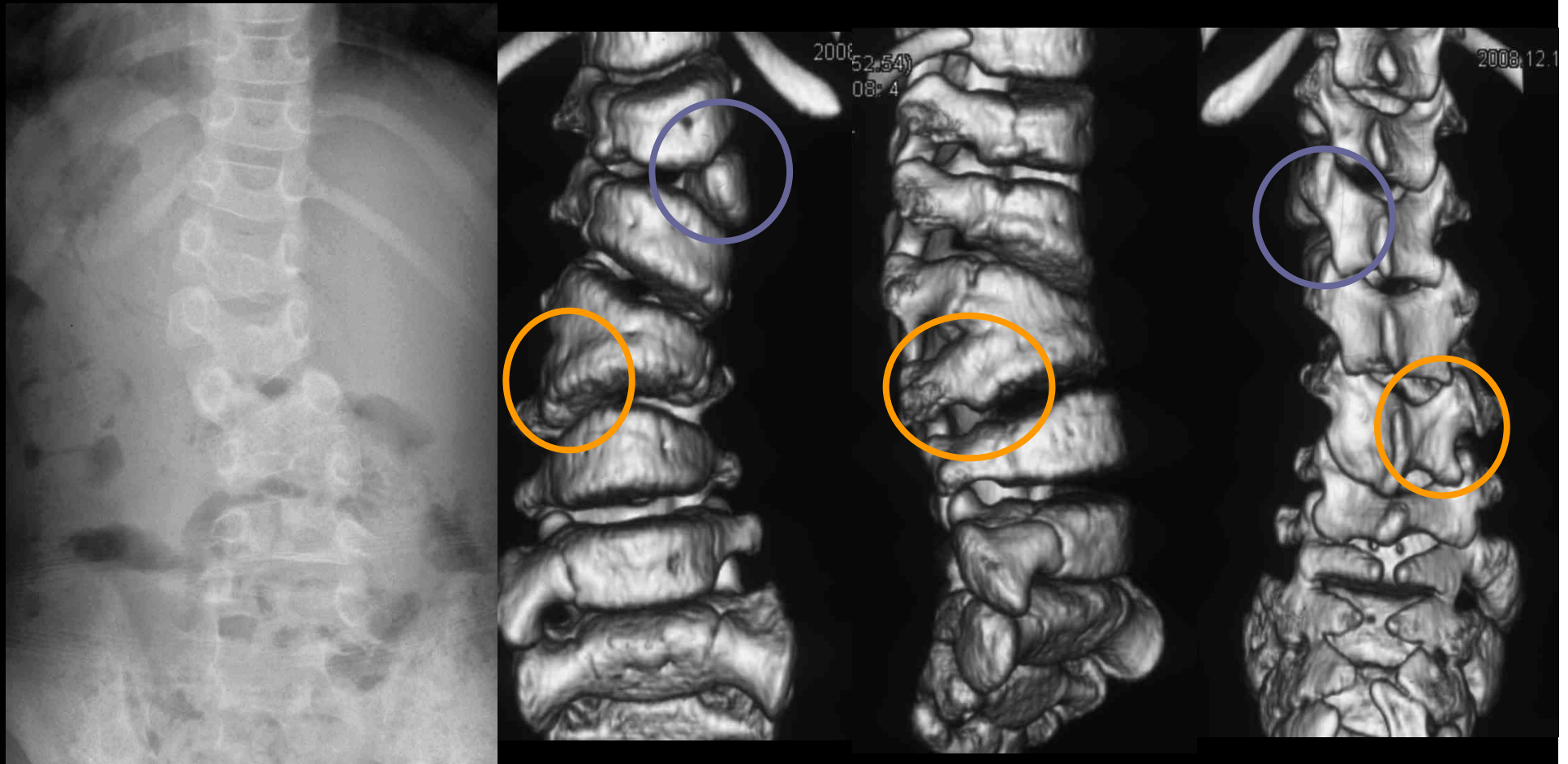FSHV: Fully Segmented Hemivertebrae

Case 1. 6 y.o. Male

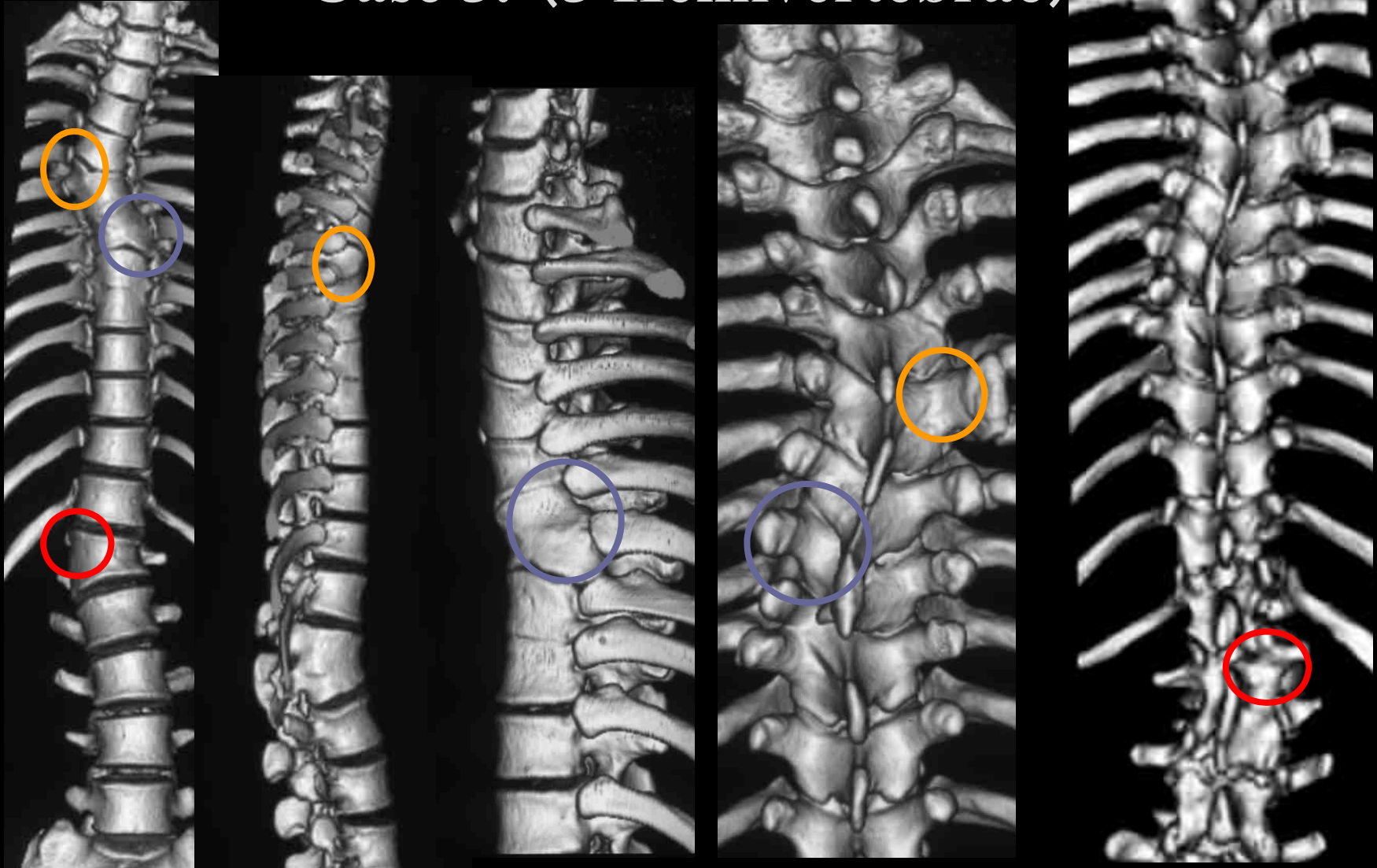Lt T11; FSHV＋FSHL, Rt L3; FSHV＋FSHL

FSHL: Fully Segmented Hemilamina

Malformations existing at the equal level in each of the anterior and posterior sides (unison HMMS).

Case 2. 5 y.o. Female

Lt L2; FSHV, Rt L4; FSHV Posterior elements are normal

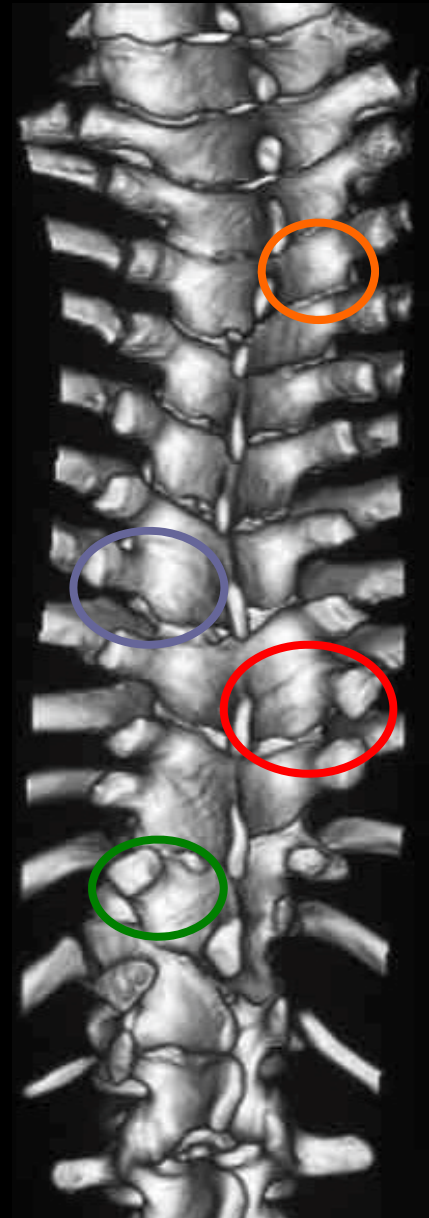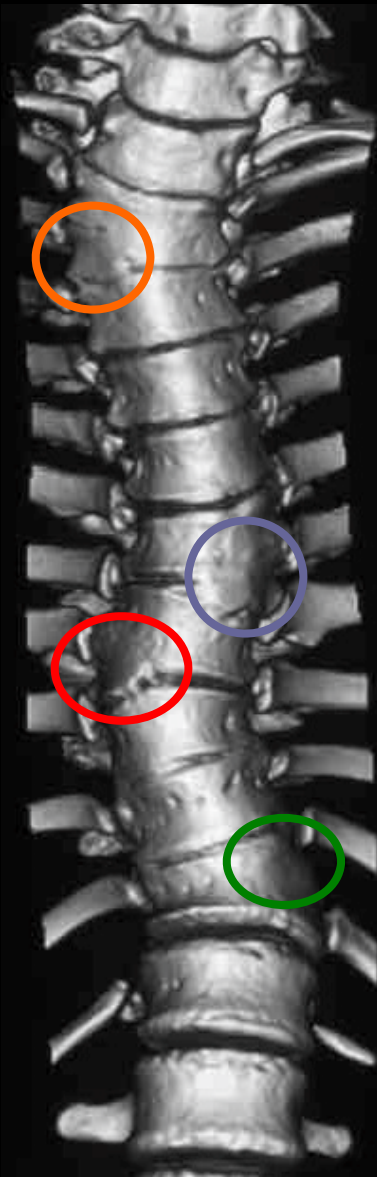Malformations existing at an unequal level in each of the anterior and posterior sides (discordant HMMS).

Case 3. （3 Hemivertebrae）

Discordant (+)

Discordant (-)

Discordant HMMS

Case 4 (4 Hemivertebrae)

○ ○ Discordant (+)
○ ○ Discordant (-)

Discordant HMMS

Differences Between Unison-HMMS and Discordant HMMS

		unison HMMS (n=7)	discordant HMMS (n=13)
Number of HVs	2	7	8
	3	0	3
	4	0	2
Average area of malformed vertebras		3.6	6.4

7 patients were classified as unison HMMS where all 7 of these patients had 2 hermivertebra. Average area of malformed vertebra in this group was 3.6. On the other hand, 13patients were classified as having discordant HMMS, where 8 patients had 2 hemivertebra, 3 had 3 hemivertebra and 2 had 4 hemivertebra. Average area of malformed vertebras were 6.4 in this group.

Conclusion

- Through the analysis of 3D-CT images, HMMS was classified into unison and discordant types.
- Discordant HMMS existed among 13 patients out of 20 (65%), where all patients with more than 3 HVs were of this type.
- Out of the 12 patients with 2 HVs, 7 patients (58%) had discordant HMMS.
- Three-dimensional evaluation of multiple HVs is mandatory to prevent wrong level surgeries.
- Although the etiology of HMMS is still unknown, it can be speculated that contralateral multiple HVs is not only a simple formation failure but instead mixed with a mismatch phenomenon; so-called "coupling failure".