

**Table S1.** Joint distributions of the different grades of C6 and C7 for the right and left side and for contralateral sides.

<b>Cervical vertebrae</b>		<b>C6-grades</b>					
<b>C6-right</b>		Grade 0	Grade 1	Grade 2	Grade 3	Grade 4	All
		11	0	0	0	28	39
<b>C7-right</b>	Grade 0	10	0	0	0	1	11
	Grade 1	1	0	0	0	1	2
	Grade 2	0	0	0	0	12	12
	Grade 3	0	0	0	0	14	14
	All	11	0	0	0	28	39
<b>C6-right</b>							
<b>C7-left</b>	Grade 0	2	0	0	0	1	3
	Grade 1	0	0	0	0	1	1
	Grade 2	4	0	0	0	9	13
	Grade 3	5	0	0	0	17	22
	All	11	0	0	0	28	39
<b>C6-left</b>		Grade 0	Grade 1	Grade 2	Grade 3	Grade 4	All
		3	0	1	1	34	39
<b>C7-left</b>	Grade 0	3	0	0	0	0	3
	Grade 1	0	0	0	0	1	1
	Grade 2	0	0	1	1	11	13
	Grade 3	0	0	0	0	22	22
	All	3	0	1	1	34	39
<b>C6-left</b>							
<b>C7-right</b>	Grade 0	2	0	1	1	7	11
	Grade 1	0	0	0	0	2	2
	Grade 2	1	0	0	0	11	12
	Grade 3	0	0	0	0	14	14
	All	3	0	1	1	34	39

**Table S2.** Joint distributions of normal and malformed C6 and C7 for the right and left side and for contralateral sides. All grades > 0 by side are encoded as 1 and normal vertebrae (grade 0) by side as 0.

<b>Cervical vertebrae</b>		<b>C6</b>		
<b>C6-right</b>		Normal	Malformed	All
		11	28	39
<b>C7-right</b>	Normal	10	1	11
	Malformed	1	27	28
	All	11	28	39
<b>C6-right</b>				
<b>C7-left</b>	Normal	2	1	3
	Malformed	9	27	36
	All	11	28	39
<b>C6-left</b>		Normal	Malformed	All
		3	36	39
<b>C7-left</b>	Normal	3	0	3
	Malformed	0	36	36
	All	3	36	39
<b>C6-left</b>				
<b>C7-right</b>	Normal	2	9	11
	Malformed	1	27	29
	All	3	36	39

**Table S3.** Joint distributions of the different grades of the length and width of the first ribs for the right and left side and for contralateral sides.

<b>Length of first rib</b>		<b>Length-grades</b>						
<b>R1-right</b>		Grade 0	Grade 1	Grade 2	Grade 3	Grade 4	Bifid	All
		12	1	3	15	2	2	35
<b>R1-left</b>	Grade 0	4	0	2	2	0	0	8
	Grade 1	2	0	0	0	0	0	2
	Grade 2	2	1	0	2	0	1	6
	Grade 3	3	0	1	10	0	1	15
	Grade 4	0	0	0	1	2	0	3
	Bifid	1	0	0	0	0	0	1
<b>Width of first rib</b>		<b>Width-grades</b>						
<b>R1-right</b>		Grade 0	Grade 1	Grade 2	Grade 3	Grade 4	Bifid	All
		10	4	1	18	2	2	37
<b>R1-left</b>	Grade 0	0	1	4	0	0	0	5
	Grade 1	3	0	0	0	0	0	3
	Grade 2	1	0	1	0	0	0	2
	Grade 3	5	3	0	13	0	2	23
	Grade 4	0	0	0	1	2	0	3
	Bifid	1	0	0	0	0	1	1
<b>Width of first rib</b>		<b>Width-grades</b>						
<b>R1-right</b>		Grade 0	Grade 1	Grade 2	Grade 3	Grade 4	Bifid	All
		10	4	0	20	2	2	38
<b>Length of R1-right</b>	Grade 0	10	3	0	0	0	0	13
	Grade 1	1	0	0	0	0	0	1
	Grade 2	0	0	0	3	0	0	3
	Grade 3	0	0	0	17	0	0	17
	Grade 4	0	0	0	0	2	0	2
	Bifid	0	0	0	0	0	2	2
<b>Width of first rib</b>	<b>Width-grades</b>							
<b>R1-right</b>		Grade 0	Grade 1	Grade 2	Grade 3	Grade 4	Bifid	All
		9	4	1	18	2	2	36
<b>Length of R1-left</b>	Grade 0	3	1	0	4	0	0	8
	Grade 1	2	0	0	0	0	0	2
	Grade 2	1	2	0	2	0	1	6
	Grade 3	2	1	2	11	0	1	16
	Grade 4	0	0	0	1	2	0	3
	Bifid	1	0	0	0	0	0	1

<b>Width of first rib</b>	<b>Width-grades</b>							
<b>R1-left</b>		Grade 0	Grade 1	Grade 2	Grade 3	Grade 4	Bifid	All
		5	3	1	23	3	1	36
<b>Length of R1-right</b>	Grade 0	1	3	1	7	0	1	13
	Grade 1	0	0	0	1	0	0	1
	Grade 2	2	0	0	1	0	0	3
	Grade 3	2	0	0	12	1	0	15
	Grade 4	0	0	0	0	2	0	2
	Bifid	0	0	0	2	0	0	2
<b>Width of first rib</b>	<b>Width-grades</b>							
<b>R1-left</b>		Grade 0	Grade 1	Grade 2	Grade 3	Grade 4	Bifid	All
		5	3	2	22	3	1	36
<b>Length of R1-left</b>	Grade 0	5	2	1	0	0	0	8
	Grade 1	0	1	0	1	0	0	2
	Grade 2	0	0	0	6	0	0	6
	Grade 3	0	0	1	15	0	0	16
	Grade 4	0	0	0	0	3	0	3
	Bifid	0	0	0	0	0	1	1

**Table S4.** Joint distributions of normal and malformed first ribs for the right and left side and for contralateral sides. All grades > 0 by side are encoded as 1 and normal ribs (grade 0) by side as 0.

<b>First ribs</b>		<b>Length</b>		
<b>Length of R1-right</b>		Normal	Malformed	All
		12	23	35
<b>Length of R1-left</b>	Normal	4	4	8
	Malformed	8	19	27
		<b>Width</b>		
<b>Width of R1-right</b>		Normal	Malformed	All
		10	27	37
<b>Width of R1-left</b>	Normal	0	5	5
	Malformed	10	22	32
		<b>Width</b>		
<b>Width of R1-right</b>		Normal	Malformed	All
		10	28	38
<b>Length of R1-right</b>	Normal	10	3	13
	Malformed	0	25	25
		<b>Width</b>		
<b>Width of R1-right</b>		Normal	Malformed	All
		9	27	36
<b>Length of R1-left</b>	Normal	3	5	8
	Malformed	6	22	28
		<b>Width</b>		
<b>Width of R1-left</b>		Normal	Malformed	All
		5	31	36
<b>Length of R1-right</b>	Normal	1	12	13
	Malformed	4	19	23
		<b>Width</b>		
<b>Width of R1-left</b>		Normal	Malformed	All
		5	31	36
<b>Length of R1-left</b>	Normal	5	3	8
	Malformed	0	28	28

**Table S5.** Joint distributions of the different grades of the width of the second ribs for the right and left side.

<b>Width of second rib</b>	<b>Width-grades</b>							
<b>R2-right</b>		Grade 0	Grade 1	Grade 2	Grade 3	Grade 4	Bifid	All
		12	15	2	0	0	2	31
<b>Width of R2-left</b>	Grade 0	4	3	0	0	0	0	7
	Grade 1	7	10	0	0	0	2	19
	Grade 2	0	2	2	0	0	0	4
	Grade 3	0	0	0	0	0	0	0
	Grade 4	0	0	0	0	0	0	0
	Bifid	1	0	0	0	0	0	1

**Table S6.** Joint distributions of the different grades of the length of the first ribs for the right and left side with the width of the second ribs.

Length of first rib		Length-grades						
R1-right		Grade 0	Grade 1	Grade 2	Grade 3	Grade 4	Bifid	All
		10	1	3	16	1	2	33
Width of R2-right	Grade 0	10	0	0	2	0	0	12
	Grade 1	0	1	2	13	1	0	17
	Grade 2	0	0	1	1	0	0	2
	Grade 3	0	0	0	0	0	0	0
	Grade 4	0	0	0	0	0	0	0
	Bifid	0	0	0	0	0	2	2
Length of first rib		Length-grades						
R1-right		Grade 0	Grade 1	Grade 2	Grade 3	Grade 4	Bifid	All
		10	1	3	14	0	2	30
Width of R2-left	Grade 0	2	0	2	3	0	0	7
	Grade 1	7	0	0	9	0	2	18
	Grade 2	0	1	1	2	0	0	4
	Grade 3	0	0	0	0	0	0	0
	Grade 4	0	0	0	0	0	0	0
	Bifid	1	0	0	0	0	0	1
Length of first rib		Length-grades						
R1-left		Grade 0	Grade 1	Grade 2	Grade 3	Grade 4	Bifid	All
		6	2	6	15	2	1	32
Width of R2-right	Grade 0	3	2	2	4	0	1	12
	Grade 1	3	0	3	8	2	0	16
	Grade 2	0	0	0	2	0	0	2
	Grade 3	0	0	0	0	0	0	0
	Grade 4	0	0	0	0	0	0	0
	Bifid	0	0	1	1	0	0	2
Length of first rib		Length-grades						
R1-left		Grade 0	Grade 1	Grade 2	Grade 3	Grade 4	Bifid	All
		6	2	6	15	1	1	31
Width of R2-left	Grade 0	4	1	0	2	0	0	7
	Grade 1	2	1	5	10	1	0	19
	Grade 2	0	0	1	3	0	0	4
	Grade 3	0	0	0	0	0	0	0
	Grade 4	0	0	0	0	0	0	0
	Bifid	0	0	0	0	0	1	1

**Table S7.** Joint distributions of the different grades of the width of the first ribs for the right and left side with the width of the second ribs.

Width of first rib		Width-grades						
<b>R1-right</b>		Grade 0	Grade 1	Grade 2	Grade 3	Grade 4	Bifid	All
		8	3	1	19	1	2	34
<b>Width of R2-right</b>	Grade 0	8	2	0	2	0	0	12
	Grade 1	0	1	1	15	1	0	18
	Grade 2	0	0	0	2	0	0	2
	Grade 3	0	0	0	0	0	0	0
	Grade 4	0	0	0	0	0	0	0
	Bifid	0	0	0	0	0	2	2
<b>Width of first rib</b>		<b>Width-grades</b>						
<b>R1-right</b>		Grade 0	Grade 1	Grade 2	Grade 3	Grade 4	Bifid	All
		8	3	1	17	0	2	31
<b>Width of R2-left</b>	Grade 0	2	0	0	5	0	0	7
	Grade 1	5	2	1	9	0	2	19
	Grade 2	0	1	0	3	0	0	4
	Grade 3	0	0	0	0	0	0	0
	Grade 4	0	0	0	0	0	0	0
	Bifid	1	0	0	0	0	0	1
<b>Width of first rib</b>	<b>Width-grades</b>							
<b>R1-left</b>		Grade 0	Grade 1	Grade 2	Grade 3	Grade 4	Bifid	All
		3	3	2	21	2	1	32
<b>Width of R2-right</b>	Grade 0	0	3	1	7	0	1	12
	Grade 1	3	0	1	10	2	0	16
	Grade 2	0	0	0	2	0	0	2
	Grade 3	0	0	0	0	0	0	0
	Grade 4	0	0	0	0	0	0	0
	Bifid	0	0	0	2	0	0	2
<b>Width of first rib</b>	<b>Width-grades</b>							
<b>R1-left</b>		Grade 0	Grade 1	Grade 2	Grade 3	Grade 4	Bifid	All
		3	3	2	21	1	1	31
<b>Width of R2-left</b>	Grade 0	3	1	0	3	0	0	7
	Grade 1	0	2	2	14	1	0	19
	Grade 2	0	0	0	4	0	0	4



	Grade 3	0	0	0	0	0	0	0
	Grade 4	0	0	0	0	0	0	0
	Bifid	0	0	0	0	0	1	1