

Anatomical Predictor For Safe Pedicle Screw Length In Spinal Surgery

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Aim

- To assess whether Inter-pedicular Distance (IPD) is an anatomical predictor for safe Pedicle Screw Length (PL) in spinal surgery
 - E.g. PL greater than IPD = Safe



Material and Methods

- Measurements made on SYNAPSE PACS (Fujifilm Healthcare)
 - T1 to L5
 - Entry Point: lateral to SAF, along the centre of the pedicle
 - Max. length for pedicle screw in expected trajectory without breaching anterior cortex
 - PL marked as "N/A" if no continuity of bone in the trajectory on axial imaging
- Independent assessors = 2
- Analysed in JASP and SPSS



Introduction

- Important to use an appropriate-length pedicle screw
 - Anterior cortical breach
 - Pull-out strength
- Ability to predict safe screw length intra-operatively
 - Useful
 - Should be simple and quick to do

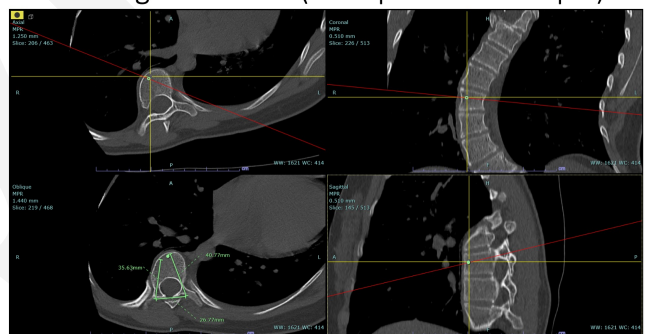


Material and Methods

- Single Centre
- 22 months period
- Adult patients with CT of the thoracolumbar spine (Group I)
- All consecutive Paediatric and Young Adult (Age 0 to 30) patients with scoliosis (Group II)
 - Had pre-operative whole spine CT imaging
- Exclusion:
 - Spinal trauma or previous surgery to spine evident on CT scan
 - Patients without CT imaging for the whole of thoracolumbar spine (T1 – L5)



Measuring PL and IPD (Example from Group II)



Measuring PL and IPD



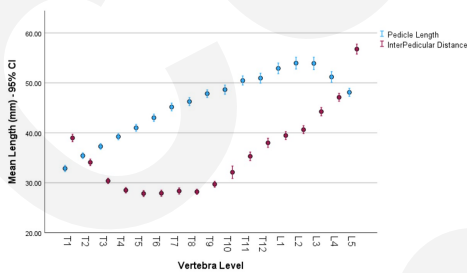
Results

	Group I (Non-Scoliosis)	Group II (Scoliosis)
No. of Patients	40	11
Gender	20M : 20F	3M : 8F
Age	Male: Mean = 25.4 (Range 20-30) Female: Mean = 25.4 (Range 19-29)	Mean = 13.3 (Range 21 months – 22 years)

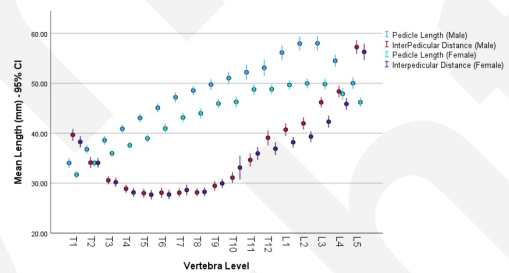
- Reliability
 - Between Assessors: 0.83-0.91 (Intraclass Co-efficient)
 - Same Assessor: 0.97-0.99 (Intraclass Co-efficient)



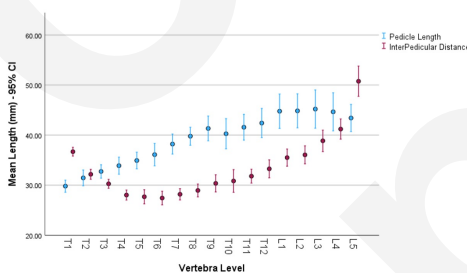
Results – Group I (Overall)



Results – Group I (Gender)



Results – Group II



Results

- In Group I (Normal Adults)
 - PL is greater than IPD between T2 and L4 ($p < 0.001$; Paired T-test)
 - PL is less than IPD at T1 and L5 ($p < 0.001$; Paired T-test)
 - No difference between gender
- In Group II (Scoliosis)
 - PL is greater than IPD between T3 and L4 ($p \leq 0.003$; Paired T-test)
 - PL is less than IPD at T1, T2 and L5 ($p < 0.001$; Paired T-test)



PL and IPD on Bone Models



Discussion

- Results support that IPD is consistently wider than the maximum safe pedicle screw length (PL) when placed along the standard trajectory
 - Caveat in the upper thoracic (T1 & T2) and lower lumbar (L5)
- Easy to use anatomical landmark for double-checking during posterior instrumentation when performing spinal surgery

Limitations

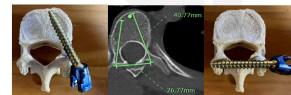
- Just because there is a pedicle, does not mean a screw is needed!
- There might not be a pedicle!
- Radiological study
 - Neurocentral synchondrosis ossification varies with age
- Small sample



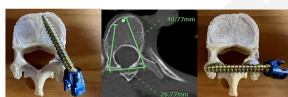
Conclusion:

IPD is a valid and readily accessible anatomical landmark for estimating the maximum safe pedicle screw length in spinal surgery, including scoliosis correction

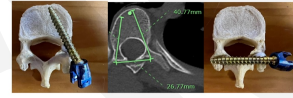
Thank you!



Questions?



Other Slide / Material



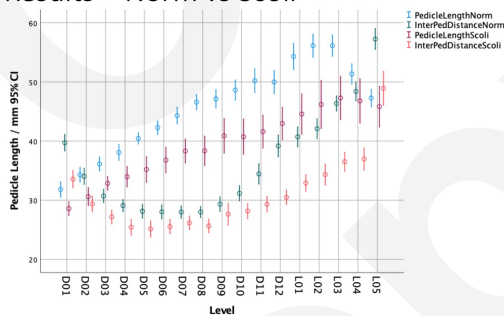
Results – Group I

- 20 consecutive males and 20 consecutive females
- Mean age
 - Male: 25.4 (Range 20-30)
 - Female: 25.4 (Range 19-29)

Results – Group II

- 13 patients with pre-op CT (10 patients @ 16yo or below)
 - 11 patients included for analysis
 - Exclusion: CT inadequate (n=2)
- Mean age at scan: 13.3 years (Range 21 months to 22 years)
- M:F = 3:8

Results – Norm vs Scoli



Results – Group II

Paired Samples T-Test									
Measure 1	Measure 2	t	df	p	Mean Difference	SE Difference	95% CI for Mean Difference		
PT1	IP11	-4.000	10	0.999	-4.464	1.116	-6.486	-2.442	ns
PT2	IP12	1.366	10	0.101	1.273	0.932	-0.416	2.961	ns
PT3	IP13	6.243	10	< .001	6.145	0.984	4.361	7.929	**
PT4	IP14	6.815	10	< .001	8.291	1.217	6.086	10.496	**
PT5	IP15	7.371	10	< .001	10.655	1.445	8.035	13.275	**
PT6	IP16	7.036	10	< .001	12.091	1.719	8.976	15.206	**
PT7	IP17	7.406	10	< .001	13.427	1.813	10.141	16.713	**
PT8	IP18	8.166	10	< .001	14.391	1.762	11.197	17.585	**
PT9	IP19	14.276	9	< .001	15.570	1.091	13.571	17.569	**
PT10	IP10	8.524	10	< .001	12.382	1.523	10.222	14.542	**
PT11	IP11	7.075	10	< .001	13.173	1.862	9.798	16.548	**
PT12	IP12	5.989	10	< .001	12.827	2.142	8.945	16.709	**
PL1	IP11	5.170	10	< .001	13.164	2.546	8.549	17.779	**
PL2	IP12	6.019	10	< .001	12.755	2.119	8.914	16.596	**
PL3	IP13	5.262	10	< .001	11.236	2.136	7.366	15.106	**
PL4	IP14	5.527	10	< .001	10.527	1.905	7.075	13.979	**
PL5	IP15	-1.200	10	0.871	-2.700	2.251	-6.779	1.379	ns

Note: For all tests, the alternative hypothesis specifies that Measure 1 is greater than Measure 2. For example, PT1 is greater than IP11.
Note: Student's t-test.