



THE CATHOLIC UNIVERSITY OF KOREA  
SEOUL ST. MARY'S HOSPITAL



# Transforaminal Endoscopic Decompression for Foraminal Stenosis: Single-Arm Meta-Analysis and Systematic Review

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# BACKGROUND

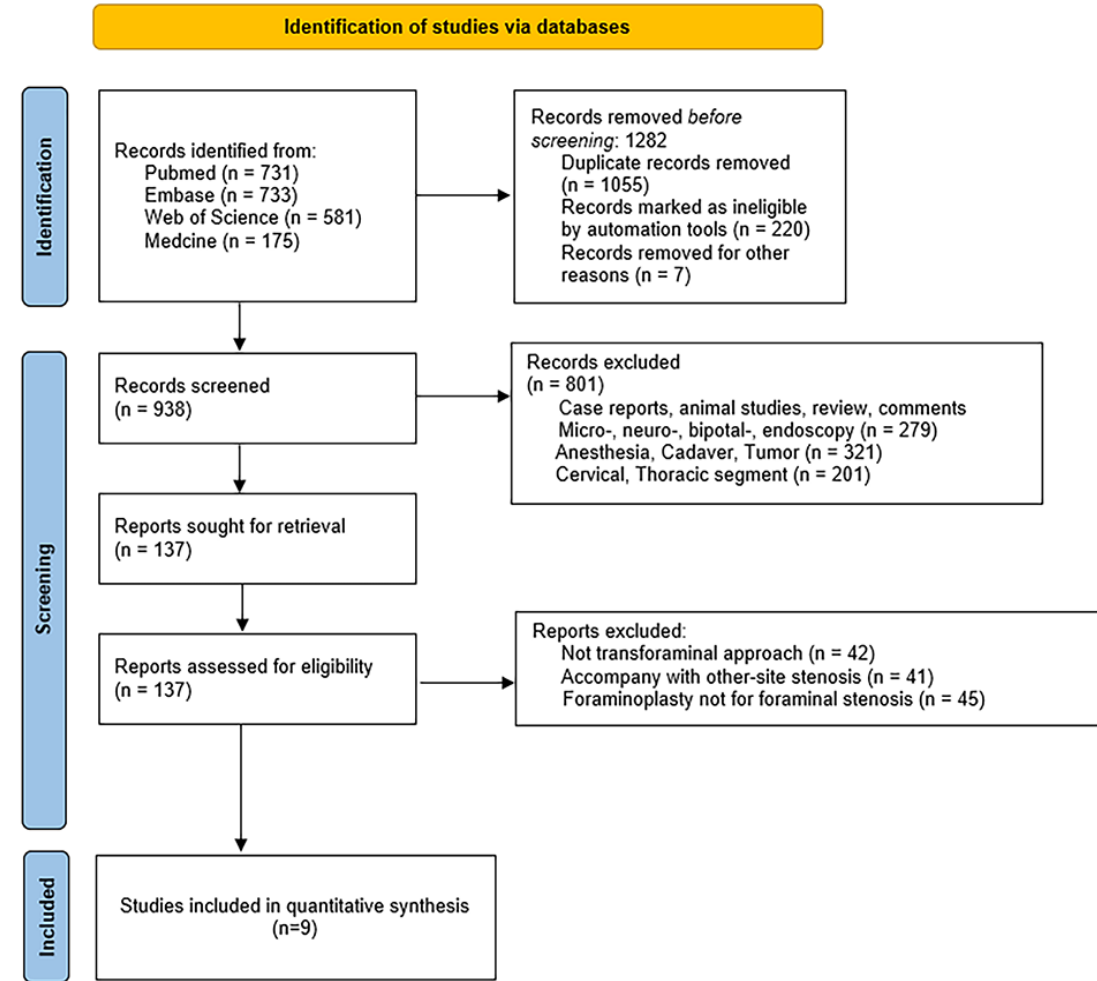
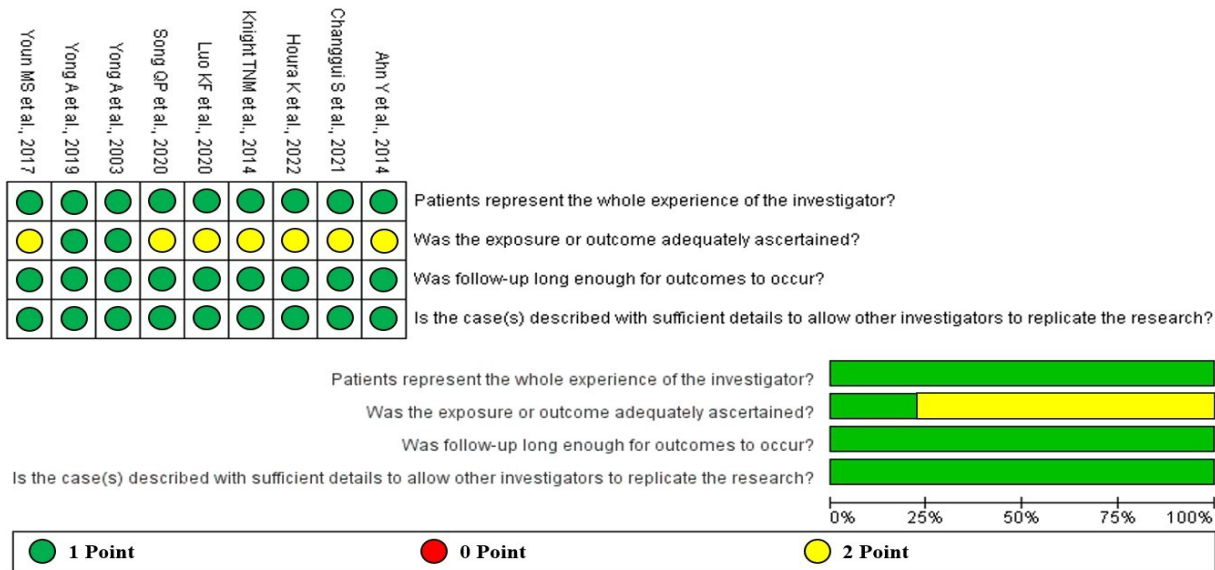
- Lumbar foraminal stenosis (LFS) is usually encountered in patients aged 60 years or older due to degenerative changes in the intervertebral disc, facet joints, and ligamentum flavum, with a reported prevalence of 8-11%.
- Transforaminal endoscopic lumbar foraminotomy (TELF) is a full-endoscopic technique that preserving the paraspinal muscles and the stability of the articular complex, reducing the surgical footprint.
- After the first endoscopic foraminotomy was reported in the early 2000s, technical and technological advances allowed a safer and more efficient procedure; however, the high-level evidence is still lacking in previous reports.

# PURPOSE

- The objective of this single-arm systematic review was to assess the effectiveness of **transforaminal endoscopic foraminal decompression (TEFD)** in patients with symptomatic LFS.

# METHODS

- Single-Arm Meta-Analysis and Systematic Review.
- Recruitment interval (RI): Inception to Feb 20, 2020.
- Two reviewers independently screened the title and abstracts.
- All statistical analyses using Stata version 16.0 software.



- **Inclusion criteria:** 1. no language restrictions; 2. Observational studies (nonrandomized designs include nonrandomized clinical trials, cohort studies, case-control, and case series); 3. Studies containing patients: - with LFS and radiculopathy as primary symptoms, confirmed by physical examinations in accordance with imaging findings; - without pain control after six weeks of conservative treatment (oral analgesics, physical therapy). - treated with lumbar transforaminal endoscopy for decompression of LFS as the primary surgical objective. 4. Studies reporting clinical evaluation outcomes (VAS, ODI, AEs, MNC scores, AEs).
- **Exclusion criteria:** 1. Case series with ten included patients or fewer; 2. Patients with previous spine surgery at the same or adjacent level. 3. Patients with unstable spondylolisthesis (demonstrated in dynamic lateral X-rays) or other concomitant diseases (tumor, fracture, infection); 4. Radiographic, cadaveric, and biomechanical studies were excluded; case reports, reviews, editorials, letters, or commentary articles were excluded. 5. Studies with cervical and thoracic procedures.

Ab: VAS (Visual Analogue Scale) , ODI (Oswestry Disability Index), AEs (adverse events), MNC (MacNab Criteria).

# RESULTS

- Baseline Data**

- The number of included articles: 9 (316 patients).
- Mean age of 61.48 years.
- The most common level for TEFD found was L5/S1, L4/5.
- 63.54 mins per level.

- Complication Data**

- Adverse events (neurological events, wound-related event, and reinterventions) (11.53%).
  - The most common neurological AE was transient postoperative dysesthesia (10.83%).
- Three studies reported reintervention (4.55%).
- No major surgical or wound-related AEs.

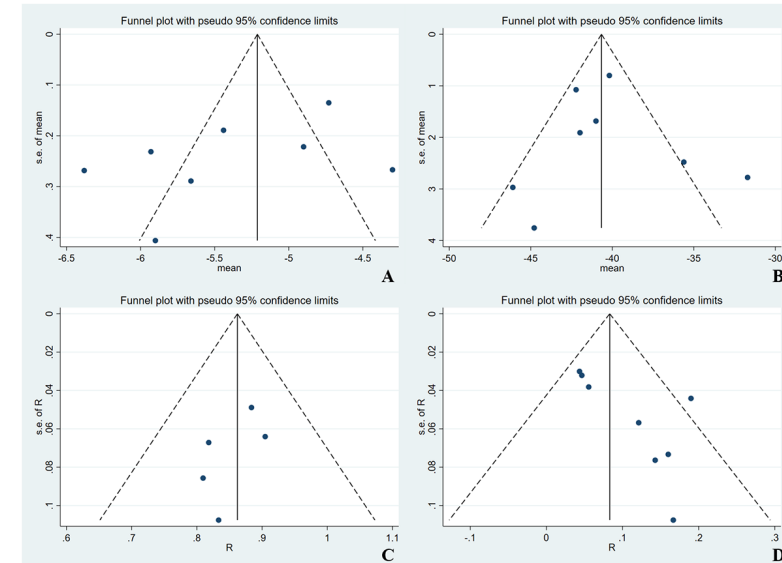
No.	Study	Patients	Age (mean)	Study design	Patients	Journal	Recruitment interval	Outcome measurement	Region	Responsible level	Foraminoplasty tool
A	Knight TNM 2014 <sup>24</sup>	79 (42F/37M)	56	P	79 (42F/37M)	Int J Spine Surg.	1997	ODI; VAS; Prolo	United Kingdom	L2-S1	laser, reamers, drills
B	Changgui S 2021 <sup>25</sup>	43 (20F/23M)	63	R	43 (20F/23M)	Int J Comput Assist Radiol Surg.	2018-2019	VAS; ODI; MNC	China	L4-S1	reamers, drills
C	Youn MS 2017 <sup>26</sup>	25 (12F/13M)	66	R	25 (12F/13M)	Acta Neurochir.	2012-2014	VAS; ODI; SF-36	South Korea	L2-S1	osteotomes (chisels)
D	Ahn Y 2019 <sup>27</sup>	21 (12F/9M)	72	R	21 (12F/9M)	World Neurosurg.	2015-2016	VAS; ODI; MNC	South Korea	L2-S1	threpines, drills
E	Song QP 2020 <sup>28</sup>	21 (11F/10M)	66	R	21 (11F/10M)	Orthop Surg.	2019-2019	VAS; ODI; MNC	China	L5-S1	threpines
F	Ahn Y 2014 <sup>29</sup>	33 (18F/15M)	64	P	33 (18F/15M)	Neurosurg.	2009-2011	VAS; ODI; MNC	South Korea	L2-S1	threpines, drills
G	Houra K 2022 <sup>30</sup>	46 (23F/23M)	60	R	46 (23F/23M)	Int J Spine Surg.	2008-2018	VAS; ODI	Croatia	L3-L5	reamers
H	Luo KF 2020 <sup>31</sup>	36 (17F/19M)	60	R	36 (17F/19M)	Zhongguo gu shang.	2013-2018	VAS; ODI	China	L4-S1	trephine
I	Yong A 2003 <sup>14</sup>	12 (7F/5M)	57	R	12 (7F/5M)	Journal of Neurosurg.	2001-2002	MNC	South Korea	L5-S1	reamers

	Adverse Events	Studies Involved	Event/Total	%
Neurological adverse events	Dysesthesia	A, C, E, F, G, H	26/240	10.83
	Persistent radicular pain	B, E, F, I	5/109	4.59
Wound related adverse events	Hematoma, CSF leak, Infection	None	0	0
Reinterventions		E, F, I	3/66	4.55
<b>Total</b>		A, B, C, E, F, G, H, I	34/295	11.53

# RESULTS \_ forest plot & publication bias

- Primary clinical outcomes**

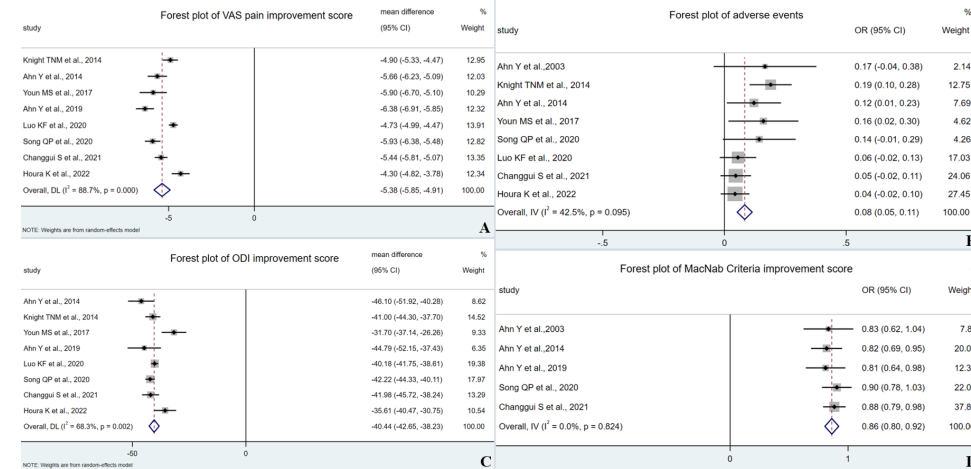
- Despite funnel plots asymmetry, Egger's test show no significant.
- Sensitivity analysis indicated the robustness of the primary clinical indicators.
- Mean VAS reduction of -5.38 ( $I^2= 88.7\%$ ,  $p= 0.000$ ).
- Mean ODI reduction of -40.44 ( $I^2= 68.3\%$ ,  $p= 0.002$ ).
- MNC scores showed positive self-rated outcomes, and 85.38% of



patients shows positive results ("Excellent and "good" ).

- Heterogeneity analysis**

- Clinical outcomes affected by the technical and technological evolution of the surgical technique.
- The overall performance of the transforaminal endoscopic technique in the treatment of LFS, improved significantly over time.



# RESULTS\_subgroup analysis

- **Meta-regression analysis**

- Age<65 had a significant effect on VAS pain scores.
- China studies had a significant effect on VAS pain scores, South Korea studies had a significant effect on ODI scores.
- Recruitment start time before 2010 or 2011-2015 had a significant effect on VAS and ODI pain.
- Recruitment start time before 2010 had a significant effect on AEs.

- **Baseline Data**

- The number of included articles: 9 (316 patients).
- Mean age of 61.48 years.
- The most common level for TEFD found was L5/S1, L4/5.
- 63.54 mins per level.

Subgroups	VAS				ODI				AE			
	No.	Effect (95%CI)	P	I <sup>2</sup>	No.	Effect (95%CI)	P	I <sup>2</sup>	No.	Effect (95%CI)	P	I <sup>2</sup>
<b>Total</b>												
<b>Mean age</b>												
Age<65	5	-4.95 (-5.12, -4.78)	-	81.3%	5	-40.71 (-42.93, -38.48)	0.081	51.8%	6	0.08 (0.04, 0.11)	0.067	51.5%
Age>65	3	-6.09 (-6.40, -5.77)	0.394	-	3	-39.50 (-46.71, -32.30)	0.001	85.2%	2	0.15 (0.05, 0.26)	0.871	-
<b>Study design</b>												
Prospective	2	-5.26 (-6.00, -4.51)	0.037	77.0%	2	-42.96 (-47.83, -38.10)	0.135	55.2%	2	0.16 (0.10, 0.23)	0.340	-
Retrospective	6	-5.43 (-6.04, -4.82)	-	91.3%	6	-39.65 (-42.30, -37.01)	0.002	73.0%	6	0.06 (0.03, 0.10)	0.481	-
<b>Region</b>												
United Kingdom	1	-4.90 (-5.33, -4.47)	-	-	1	-40.72 (-50.38, -31.06)	0.001	86.5%	1	0.19 (0.10, 0.28)	-	-
South Korea	3	-6.00 (-6.47, -5.54)	0.179	41.8%	3	-41.00 (-44.30, -37.70)	-	-	3	0.14 (0.06, 0.22)	0.885	-
China	3	-5.35 (-6.05, -4.64)	-	91.5%	3	-41.13 (-42.57, -39.69)	0.273	23.1%	3	0.06 (0.01, 0.10)	0.505	-
Croatia	1	-4.30 (-4.82, -3.78)	-	-	1	-35.61 (-40.47, -30.75)	-	-	1	0.04 (-0.02, 0.10)	-	-
<b>Recruitment interval</b>												
-2010	3	-4.95 (-5.66, -4.23)	0.003	83.3%	3	-40.72 (-45.86, -35.58)	0.023	73.5%	4	0.10 (0.05, 0.14)	0.042	63.4%
2010-2015	3	-5.65 (-6.83, -4.46)	-	94.1%	3	-38.69 (-44.85, -32.52)	0.005	80.9%	2	0.08 (0.01, 0.14)	0.206	37.4%
2015-	2	-5.67 (-6.15, -5.19)	0.101	62.8%	2	-42.16 (-44.00, -40.33)	0.913	-	2	0.06 (0.00, 0.12)	0.245	26.1%

\*Abbreviations: VAS: Visual Analog Scale; ODI: Oswestry Disability Index; AE: adverse events; CI: confidence interval.

†P < 0.05 was considered statistically significant contributions to the heterogeneity of effect.

DH : disc height, SL : segmental lordosis, LL : lumbar lordosis



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# LIMITATIONS

- Less randomized nonrandomized trials (only 9 )
- Lack of comparative studies on the general and standardized radiographic grading systems of foramina stenosis.
- Physicians' professional proficiency in the techniques among different institutes and countries may result in bias.
- Highly heterogeneous articles were present in the subgroup of patients aged <65 years, we could not determine whether the age difference was the cause of the high heterogeneity, which would require the inclusion of more articles in the future to create more subgroups for further analysis.

# CONCLUSION

- Transforaminal endoscopy technique is effective and safe in the treatment of symptomatic lumbar foraminal stenosis.

## THANK YOU FOR YOUR ATTENTION~

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