

The New S3 Guideline on “Epidural injections”

Die neue S3-Leitlinie „Epidurale Injektionen“

Authors

Stephan Klessinger 

Affiliations

Neurosurgery, Neurosurgery Biberach, Biberach, Germany

Keywords

spine, interventional procedures, education, technical aspects, treatment effects

received 4.8.2025

accepted after revision 10.9.2025

published online 29.9.2025

Bibliography

Rofo 2026; 198: 604–609

DOI 10.1055/a-2702-4560

ISSN 1438-9029

© 2025. Thieme. All rights reserved.

Georg Thieme Verlag KG, Oswald-Hesse-Straße 50,
70469 Stuttgart, Germany

Correspondence

Prof. Dr. Stephan Klessinger

Neurosurgery, Neurosurgery Biberach, Biberach, Germany
klessinger@neurochirurgie-bc.de

 Deutsche Version unter: <https://doi.org/10.1055/a-2702-4560>.

ABSTRACT

Background Epidural injections are frequently performed for radicular pain. The German Society for Spine Surgery (DWG) published an S3 guideline for assessing benefits and performing epidural injections. The goal is to standardize the indication, technique, and medication selection based on evidence.

Material and Methods The guideline was developed with the participation of ten professional associations and a patient representative using the AGREE II tool. It was based on a systematic literature review with GRADE assessment. Fourteen PICO questions were addressed.

Results The evidence varies greatly depending on the approach and region. Transforaminal injections are recommended for radicular pain. Interlaminar injections have been shown to have a short-term effect for radicular pain in the lumbar spine. All randomized benefit assessment studies used fluoroscopy for transforaminal injections. CT or ultrasound scanning is also possible. Particulate steroids and preparations containing potentially neurotoxic preservatives should be avoided due to the potential for serious complica-

tions. Neurological follow-up and patient feedback are important. Repeat injections are only indicated if there has been a prior response. Series of injections without assessing the efficacy should not be performed.

Conclusion The new S3 guideline provides practical, evidence-based recommendations for the safe performance of epidural injections. It offers important guidance on indication, technique, and drug selection. Individual medical assessment remains essential.

Key Points

- Periradicular therapy (PRT) is an image-guided transforaminal injection into the epidural space at a defined nerve root.
- The standard is fluoroscopy. The use of CT scanning is also possible.
- Non-particulate steroids (dexamethasone) are preferable due to lower complication rates.
- Neurological examination and monitoring of the patient is important after an intervention.
- A repeat transforaminal injection should only be performed if a positive response was previously found.

Citation Format

- Klessinger S. The New S3 Guideline on “Epidural injections”. Rofo 2026; 198: 604–609

ZUSAMMENFASSUNG

Hintergrund Epidurale Injektionen werden häufig bei radikulären Schmerzen durchgeführt. Die Deutsche Wirbelsäulengesellschaft (DWG) veröffentlichte im Juni 2025 eine S3-Leitlinie zur Nutzenbewertung und Durchführung epiduraler Injektionen. Ziel ist es, die Indikationsstellung, Technik und Medikamentenauswahl evidenzbasiert zu standardisieren.

Methode Die Leitlinie wurde unter Beteiligung von zehn Fachgesellschaften und einer Patientenvertretung mit dem AGREE-II-Instrument erstellt. Grundlage war eine systematische Literaturrecherche mit Bewertung nach GRADE. Vierzehn PICO-Fragen wurden bearbeitet.

Ergebnisse Die Evidenzlage variiert stark je nach Zugang und Region. Transforaminale Injektionen werden bei radikulären Beschwerden empfohlen. Für interlaminäre Injektionen findet sich eine Kurzzeitwirkung bei radikulären Beschwerden an der Lendenwirbelsäule. Alle randomisierten Studien zur Nutzenbewertung haben für transforaminale Injektionen die Durchleuchtung genutzt. Möglich ist auch die Nutzung der CT oder des Ultraschalls. Kristalline Steroide und Präparate

mit potenziell neurotoxischen Konservierungsstoffen sind zu vermeiden, da schwerwiegende Komplikationen möglich sind. Eine neurologische Nachkontrolle und Rückmeldung des Patienten sind wichtig. Wiederholungsinjektionen sind nur bei vorangehendem Ansprechen indiziert. Serien von Injektionen ohne Beurteilung der Wirkung sollten nicht durchgeführt werden.

Schlussfolgerung Die neue S3-Leitlinie liefert praxisnahe, evidenzbasierte Empfehlungen zur sicheren Durchführung epiduraler Injektionen. Sie bietet eine wichtige Orientierung zur Indikationsstellung, Technik und Medikamentenauswahl. Die individuelle ärztliche Abwägung bleibt unverzichtbar.

- Kernaussagen**
- Eine Periradikuläre Therapie (PRT) ist eine bildgeführte transforaminale Injektion in den Epiduralraum an eine definierte Nervenwurzel.
 - Goldstandard ist die Durchführung unter Durchleuchtung. Die Verwendung eines CT ist ebenso möglich.
 - Nicht-kristalline Kortisonpräparate (Dexamethason) sind bei geringerem Risikopotenzial zu bevorzugen.
 - Die neurologische Untersuchung und Überwachung des Patienten nach einer Intervention sind wichtig.
 - Eine Wiederholung einer transforaminalen Injektion sollte nur bei zuvor positivem Ansprechen erfolgen.

Introduction

Epidural injections are the most commonly performed injections for disc herniation and radicular pain [1]. In a recent analysis of DeGIR registry data, over 70% of radiological pain therapies were epidural injections [2]. However, controversies exist regarding the ideal indication, the technical implementation, and the drugs to be used. The German Society for Spine Surgery (DWG) has therefore commissioned an S3 guideline intended to provide a benefit assessment of epidural injections and evidence-based recommendations for their practical implementation. The guideline was published by the AWMF at the end of June 2025 [3].

Ten professional associations, including the German Radiological Society (DRG) and the German Society for Neuroradiology (DGNR), as well as a group representing patients, were involved in developing the guideline. A systematic literature search was conducted, followed by an evaluation according to GRADE (Grading of Recommendations, Assessment, Development, and Evaluation) [4]. The final guideline was adopted by all participating professional societies after the neutrally moderated consensus conference and evaluated by the AWMF based on the criteria of the Assessment of Guidelines for Research and Evaluation II (AGREE II) [5].

Fourteen PICO questions [6] were studied (info-box). The recommendation levels were A: strong recommendation; B: weak recommendation; 0: recommendation open; and EC: expert consensus applied.

This overview presents individual aspects of the guideline. The entire guideline with all recommendations and statements, as well as the related literature, can be downloaded from the AWMF [3].



Definition

With an epidural injection, the objective is clearly defined. Imaging is used to ensure that this objective is reached in a definitive way. Contrast medium is administered in order to anticipate the distribution of the drug. This is to ensure that the intended target (e.g. a nerve root) is reached in order to achieve good and reproducible results.

► Info-box: 14 PICO questions were studied in the guideline	
Definition	1. How are epidural injections defined?
Benefit assessment	2. What are the indications and evidence for diagnostic transforaminal epidural injections? 3. What are the indications and evidence for therapeutic transforaminal injections (PRT)? 4. What are the indications and evidence for interlaminar injections? 5. What are the indications and evidence for caudal injections?
Requirements	6. Is non-interventional, conservative therapy a prerequisite before an epidural injection?
Procedure	7. What imaging procedure is required for performing an epidural injection? 8. What technical aspects should be considered when performing an epidural injection? 9. Which medications are suitable for an epidural injection? 10. Do anticoagulants and antiplatelet drugs need to be discontinued before an epidural injection?
Complications	11. Are epidural injections safe? What are typical complications?
Comparison of approaches	12. Are there different indications and evidence for an interlaminar, caudal, or transforaminal injection?
Repetition	13. When is it advisable to repeat an epidural injection?
Care aspects	14. What aspects of care need to be considered when administering an epidural injection?

However, the language used to describe the interventions is often not so precise. For example, the term nerve root (paired structure: radix anterior motor, radix posterior sensory, intradural) is used synonymously with the term spinal nerve (union of the two nerve roots, mixed nerve, extradural). Additionally, the concept “periradicular therapy” (PRT) is sometimes also used as an umbrella term for various interventions on the spine, although “radicular” refers to the nerve root (and not the spinal nerve).

The guideline group thus sought to provide a clear definition of the different epidural injections in the first PICO question. The three possible approaches to the epidural space (transforaminal, interlaminar, and caudal) were identified, and epidural injections were differentiated from other injections in the spine.

The guideline provides the following recommendations and statements [3]:

- “There are three different approaches to the epidural space (transforaminal, interlaminar, and caudal) that **should** be differentiated with regard to indication, efficacy, risks, and implementation.” (Recommendation level A)
- “The term periradicular therapy, or PRT, refers to an image-guided transforaminal injection into the epidural space at a defined nerve root.”
- “For a transforaminal injection, the contrast agent or medication **should** reach the preganglionic epidural space.” (Recommendation level B)
- “In case of an interlaminar injection, the medication **should** reach the ventral epidural space.” (Recommendation level B)

Benefit assessment

In the benefit assessment, the guideline evaluated both randomized trials (RCTs) as well as observational studies and reviews. The quality of the evidence was assessed according to GRADE criteria [4]. A distinction was made between the different approaches to the epidural space and the two regions, the cervical and lumbar spine. In addition, studies with and without imaging were evaluated separately. With the transforaminal approach, a distinction has to be made between diagnostic and therapeutic injections.

There is low evidence for transforaminal injections in the cervical spine, as no randomized studies exist. However, three systematic reviews come to a similar result with approximately 50% success (50% pain reduction for 1–3 months). All RCTs for the lumbar spine were performed under fluoroscopy and with contrast medium. When comparing local anesthesia with cortisone versus sham or conservative therapy, the RCTs with high evidence showed significantly better results in the injection group. Recent meta-analyses also show an effect of transforaminal injections with cortisone under fluoroscopy in disc-related radicular complaints.

All RCTs for interlaminar injections of the cervical spine were performed using fluoroscopy. For the lumbar spine, RCTs with and without imaging were conducted. The studies are highly heterogeneous. There is no evidence for or against the efficacy of lumbar spine injections without imaging. In contrast, imaging-based RCTs, reviews, and international guidelines provide a little evidence of a short-term effect for radicular pain but not for back pain.

The results for caudal injections can be found in the long version of the guideline [3].

The guideline provides the following recommendations [3]:

- “Transforaminal therapeutic injections under fluoroscopy **can** be considered in cases of radicular complaints originating from the cervical spine.” (Recommendation level 0)
- “Transforaminal therapeutic injections under fluoroscopy **should** be offered for radicular pain caused by a lumbar disc herniation.” (Recommendation level B)
- “Interlaminar injections under fluoroscopy **can** be considered in cases of radicular complaints originating from the cervical spine.” (Recommendation level 0)
- “Interlaminar injections **can** be considered in cases of radicular complaints originating from the lumbar spine.” (Recommendation level 0)
- “Interlaminar injections in the lumbar spine **should** be performed using an imaging procedure if the technical requirements are met.” (Recommendation level B)

Procedure

Epidural injections are performed in very different ways. This applies to the selection of the imaging procedure, the desired target position of the needle, and also the medications used. The guideline investigated which procedures have evidence in the literature. The guideline only mentions procedures with evidence, which does not mean that there may not be other approaches that also lead to good results.

Imaging procedures

For the cervical spine, an imaging procedure is commonly used for both transforaminal and interlaminar approaches. For the lumbar spine, transforaminal injections are also regularly performed with the assistance of imaging. Lumbar interlaminar injections and caudal injections are performed in the studies with and without imaging procedures.

In all randomized trials used to assess the benefit, fluoroscopy was used for transforaminal injection. Ultrasound or CT was not used in studies with high- or moderate-quality evidence. The RCTs evaluating the benefits of interlaminar injections in the cervical spine were also conducted exclusively using fluoroscopy. This data contradicts the analysis of the DeGIR data from 2021, which showed that the radiologists involved used CT in more than 95% of interventions [2]. One reason for this discrepancy could be regional differences. In the countries where most of the studies were conducted, CT is less commonly used for interventions.

However, there are a number of observational studies that have used CT or ultrasound, and there are also studies that have compared the different procedures. The studies that compared ultrasound with fluoroscopy or CT of the cervical spine did not show significant differences in clinical success. A study showed better results in the cervical spine using CT fluoroscopy compared to fluoroscopy [7]. None of the studies on the lumbar spine were able to demonstrate a significant difference in clinical outcomes.

The guideline provides the following recommendations [3]:

- “The gold standard for transforaminal and interlaminar injections is fluoroscopy. Transforaminal injections (PRT) and interlaminar injections in the cervical and lumbar spine **should** be performed under fluoroscopy.” (Recommendation level B)
- “For a transforaminal and interlaminar injection, CT or ultrasound **can** be used.” (Recommendation level 0)
- “When CT is used as an imaging modality, CT fluoroscopy **can** be performed without a planning scan.” (Recommendation level 0)

Approaches

The studies on transforaminal injections with fluoroscopy in the lumbar spine identify different needle positions in the epidural space in the neuroforamen. In the classic approach, the needle is placed supraneurally under the pedicle. However, an infraneural needle position is also common.

For interlaminar injections, a distinction is made between a sagittal midline approach and a parasagittal approach. Depth control is often more difficult under fluoroscopy in the lateral image than with a contralateral oblique view. It seems sensible to perform an epidural injection in the cervical spine at a level where an epidural space is available. Generally, epidural fatty tissue of sufficient thickness is found only in the lowest levels of the cervical spine on MRI [8].

The guideline provides the following recommendations [3]:

- “When planning the approach for a transforaminal injection of the lumbar spine (PRT), the infraneural approach **should** also be considered, in addition to the classic subpedicular (supraneural) approach.” (Recommendation level A)
- “In the case of an interlaminar approach to the cervical or lumbar spine, a parasagittal approach **should** be used.” (Recommendation level A)
- “To detect needle depth and contrast medium spread during an interlaminar approach under fluoroscopy, a contralateral oblique view **should** be used.” (Recommendation level B)
- “A cervical interlaminar injection **should** be administered at the level of Hw7/Bw1 and not cranial to Hw6/7.” (Recommendation level B)

Medications for injection

Local anesthetics and cortisone preparations are often used for epidural injections. When selecting these preparations, it is important to consider the different risk potential regarding serious complications. Particularly after transforaminal injections in the cervical and lumbar spine, studies have reported ischemia of the spinal cord or brain with paresis and paraplegia, as well as cases of death.

One possible cause of these complications is thromboembolic events resulting from the injection of crystalline cortisone in an artery supplying the spinal cord or brain. The size of the particles or the aggregation of the particles in crystalline cortisone (e.g. triamcinolone, methylprednisolone, betamethasone) is larger than erythrocytes. As a result, vessels can be embolized [9]. A de-

formation of the cell membrane of the erythrocytes with subsequent aggregation of the erythrocytes by these preparations might also explain this outcome [10].

In animal models, the relative safety of dexamethasone as a non-crystalline, water-soluble cortisone has been demonstrated [11, 12]. It should be noted, however, that mixing dexamethasone with ropivacaine in one syringe may result in the formation of crystals.

In recent years, there have been contradictory reports in Germany regarding the approval of cortisone preparations for injections into the epidural space. In 2014, the National Association of Statutory Health Insurance Physicians announced that there was an “expansion of the indication for Volon A 40 crystal suspension 1 ml and 5 ml (triamcinolone)” [13]. This cortisone preparation is approved for perineuritis and radiculopathy when the drug is applied “intrafocally” around the nerve root. Therefore, periradicular therapy (PRT) is not an off-label use. However, epidural use was explicitly excluded. This is a contradiction, as the nerve root (radix) can only be reached via injection into the epidural space. In the international literature, epidural injections are clearly defined as epidural injections, and it is pointed out that the use of cortisone for epidurals is off-label.

The guideline provides the following recommendations and statements [3]:

- “A mixture of ropivacaine with dexamethasone **should not** be used for epidural injection, as aggregates form which can lead to embolisms if injected intra-arterially.” (Recommendation level A)
- “For a transforaminal injection at the cervical spine, only non-crystalline cortisone (e.g. dexamethasone) **should** be used.” (Recommendation level A)
- “For a transforaminal injection at the lumbar spine, a non-crystalline cortisone (e.g. dexamethasone) **should** be the first choice.” (Recommendation level B)
- “For epidural application, cortisone preparations without preservatives (such as benzyl alcohol) **should** be the preferred choice.” (Recommendation level B)
- “At the time of the guideline’s publication, cortisone preparations are not approved for epidural use (interlaminar, transforaminal, periradicular, PRT). Their use is therefore off-label.”

Anticoagulants and antiplatelet agents

In patients taking antiplatelet agents or anticoagulants, a risk-benefit assessment is necessary to determine whether these medications should be discontinued. The question that needs to be clarified is whether the risk of hematoma is greater with continuous use of the medication or the risk of thromboembolic disease is greater when the medication is discontinued.

The existing guidelines of international professional associations contain contradictory classifications of individual interventions into risk groups and also contradictory recommendations. Therefore, it is not possible to make a clear recommendation regarding the different epidural injections.

The guideline provides the following recommendations and statements [3]:

- “With interlaminar injections, there is a non-negligible risk of epidural hematoma.”
- “In an epidural injection, an individual risk/benefit assessment **should** be carried out for each patient regarding the continuation or discontinuation of anticoagulants or antiplatelet agents.” (Recommendation level A)

Complications

Serious complications following epidural injections are very rare: at the cervical spine 0.00294% and at the lumbar spine 0.00051% [14].

Non-serious complications to be considered during the intervention include vasovagal syncope, dural puncture, increased pain, nerve injuries, and seizures. Allergic reactions and infections may occur after the intervention. An epidural hematoma often only becomes symptomatic minutes to days after the intervention.

Therefore, it is important to monitor even an initially normal patient after the intervention and to inform them about possible late complications (such as infection).

The guideline provides the following recommendations and statements [3]:

- “Complications following epidural interventions are very rare overall, but very severe complications have been reported in case histories in the literature.”
- “The existing imaging (especially MRI) **should** be assessed for anatomical features (e.g. course of the vertebral artery) before an epidural injection.” (Recommendation level A)
- “After an intervention, the patient should be neurologically examined and monitored to detect early complications.” (Recommendation level A)
- “Patient feedback (in person, in writing, by telephone) **should** be obtained within the first 14 days after the intervention in order to detect late complications.” (Recommendation level B)

Comparison of approaches

The risk of serious complications in the cervical spine must be taken into account. With the transforaminal approach, there is a risk of intra-arterial injection (which is particularly risky with crystalline cortisone); with the interlaminar approach, there is a risk of spinal cord puncture. The RCT and observational studies show no significant difference between the two approaches in clinical outcome.

For the lumbar spine, three randomized trials demonstrated the superiority of the interlaminar approach versus the transforaminal approach, but 10 studies showed better results with the transforaminal approach. Five studies showed no significant difference.

The guideline provides the following recommendations [3]:

- “In the case of radicular complaints originating from the cervical spine, both a transforaminal approach and an interlaminar approach **can** be considered.” (Recommendation level 0)
- “In cases of radicular complaints originating in the lumbar spine, a transforaminal approach **can** be preferred over an interlaminar approach.” (Recommendation level 0)

Repetition

The question often arises whether it makes sense to repeat an epidural injection and after what interval of time. A repeated injection only makes sense if there is a positive response but the effect is insufficient. In this case, it is important to wait for the maximum effect of the injection to occur.

The guideline provides the following recommendations and statements [3]:

- “A repeat epidural injection should only be performed in cases of a previously positive response (e.g. reduction of the VAS by at least 2 points), insufficient effect, or recurring symptoms at least 1–3 weeks after the previous injection.” (Recommendation level B)
- “Repeating the same injection without the previous injection having shown an effect or carrying out a series of injections without assessing the effect between injections **should not** be performed.” (Recommendation level B)
- “The number of injections **should** be limited, taking into account the maximum dose of 200 mg (3 mg per kg body weight) of methylprednisolone equivalent per year.” (Recommendation level B)

Limitations

This article presents a selection of recommendations and statements from the guideline. In the process of developing the guideline, there were many discussions regarding possible options for performing epidural injections. The recommendations of this guideline are based on a systematic review of the evidence in the literature. In addition, there are also expert opinions that sometimes differ from the recommendations but, of course, also have to be taken into account.

Conflict of Interest

Paid lectures for Stryker and Boston Scientific. Book author at Thieme, De Gruyter.

References

- [1] Manchikanti L, Knezevic E, Knezevic NN et al. Epidural Injections for Lumbar Radiculopathy or Sciatica: A Comparative Systematic Review and Meta-Analysis of Cochrane Review. *Pain Physician* 2021; 24: E539–E554
- [2] Fessler R, Wacker FK, Wilhelm K et al. Radiologische Schmerztherapien an der Wirbelsäule – Retrospektive Auswertung der DeGIR-Registerdaten 2021. *Rofo* 2025. doi:10.1055/a-2657-9236

- [3] Klessinger S, Wiechert K. Deutsche Wirbelsäulengesellschaft. S3-Leitlinie Epidurale Injektionen bei degenerativen Erkrankungen. Version 01, 2025. <https://register.awmf.org/de/leitlinien/detail/151-005>
- [4] Guyatt GH, Oxman AD, Vist GE et al. GRADE: an emerging consensus on rating quality of evidence and strength of recommendations. *BMJ* 2008; 336: 924–926. doi:10.1136/bmj.39489.470347.AD
- [5] Brouwers MC, Kho ME, Browman GP et al. AGREE II: advancing guideline development, reporting and evaluation in health care. *CMAJ* 2010; 182: E839–E842. doi:10.1503/cmaj.090449
- [6] Guyatt GH, Oxman AD, Kunz R et al. GRADE guidelines: 2. Framing the question and deciding on important outcomes. *J Clin Epidemiol* 2011; 64: 395–400. doi:10.1016/j.jclinepi.2010.09.012
- [7] Lee JH, Lee S-H. Comparison of clinical effectiveness of cervical transforaminal steroid injection according to different radiological guidances (C-arm fluoroscopy vs. computed tomography fluoroscopy). *The Spine Journal* 2011; 11: 416–423. doi:10.1016/j.spinee.2011.04.004
- [8] Maus T. The Anatomy, Technique, Safety, and Efficacy of Image-Guided Epidural Access. *Radiologic Clinics of North America* 2024; 62: 199–215. doi:10.1016/j.rcl.2023.09.006
- [9] Derby R, Lee S-H, Date ES et al. Size and Aggregation of Corticosteroids Used for Epidural Injections. *Pain Med* 2008; 9: 227–234. doi:10.1111/j.1526-4637.2007.00341.x
- [10] Laredo J-D, Wybier M, Laemmel E et al. Intra-arterial injection of particulate corticosteroids: mechanism of injury. *Skeletal Radiol* 2023; 52: 1887–1892. doi:10.1007/s00256-022-04273-5
- [11] Dawley JD, Moeller-Bertram T, Wallace MS et al. Intra-Arterial Injection in the Rat Brain: Evaluation of Steroids Used for Transforaminal Epidurals. *Spine* 2009; 34: 1638–1643. doi:10.1097/BRS.0b013e3181ac0018
- [12] Okubadejo GO, Talcott MR, Schmidt RE et al. Perils of Intravascular Methylprednisolone Injection into the Vertebral Artery: An Animal Study. *The Journal of Bone and Joint Surgery-American Volume* 2008; 90: 1932–1938
- [13] Kassenärztliche Bundesvereinigung. Einsatz von Kortikoiden bei wirbelsäulennahen Injektionen: Erweiterung der Indikation bei Volon A 40 Kristallsuspension 1 ml und 5 ml. Information der KBV 2014; 211
- [14] Eworuke E, Crisafi L, Liao J et al. Risk of serious spinal adverse events associated with epidural corticosteroid injections in the Medicare population. *Reg Anesth Pain Med* 2021; 46: 203–209