Extended Reality for Neuraxial Anesthesia and Pain Procedures: A Scoping Review

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| Introduction

Extended reality (XR), encompassing augmented reality, mixed reality, and virtual reality, has emerged as a potential tool for improving neuraxial procedures. XR can overlay virtual anatomic or navigational information into physical space and allow real-time guidance without radiation exposure.

| Methods

After pre-registration [1], a scoping review was performed to provide insight into the clinical and educational applications of XR for neuraxial procedures. A search for the following keyword was performed across four databases and two clinical trial registries:

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((augmented OR extended OR mixed OR virtual)
AND reality)
AND
(epidural OR peridural OR intrathecal OR
spinal OR neuraxial)
AND
(anesthesia or pain)
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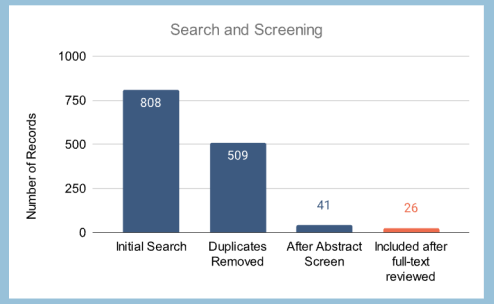
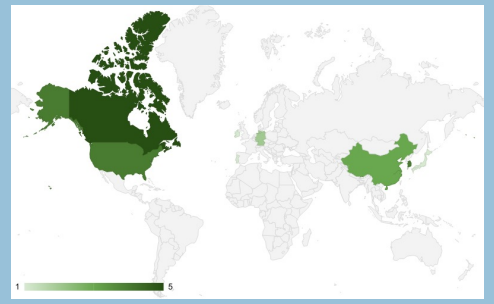
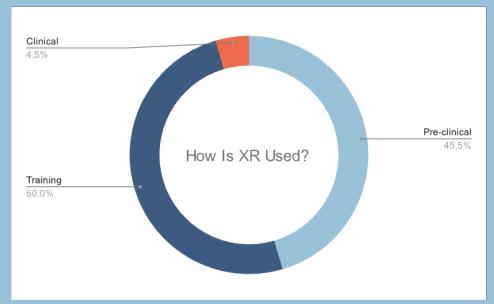
| Key Findings





- Authors from Canada, South Korea, the United States, and China have contributed significantly to the published studies, reflecting global interest in XR.



- 65% of included records were published after 2021.
- Patient-facing use of XR in neuraxial procedures remains uncommon, with only one published study reporting successful pre-procedural virtual reality planning prior to completing a previously unsuccessful procedure [2].

| Discussion

While the published studies demonstrate significant progress, cost remains a substantial barrier to widespread adoption in education, and the challenge of achieving accurate image registration hinders routine clinical use. Addressing these limitations and developing a low-cost, reliable XR neuraxial navigation system will be a crucial step in advancing clinical care and education in this field.

| References and Disclosures

1. Cho J, Thaker D. Extended Reality for Neuraxial Anesthesia and Pain Procedures: A Scoping Review Protocol. doi:10.17605/OSF.IO/5U7ZS.

2. Seong H, Yun D, Yoon KS, Kwak JS, Koh JC. Development of pre-procedure virtual simulation for challenging interventional procedures: an experimental study with clinical application. Korean J Pain. 2022 Oct 1;35(4):403-412. doi: 10.3344/kjp.2022.35.4.403. PMID: 36175339; PMCID: PMC9530692.

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