

The Importance of Meta-analyses and Systematic Reviews in Orthopedic Surgery

Integrating evidence-based medicine into practice has become essential for every orthopedic surgeon and trainee for improved education and patient care. However, the literature in orthopedic surgery is expansive and maintaining up-to-date knowledge is difficult in conjunction with high volume of clinical practice. In addition, the emerging evidence is vast and can be ambiguous to interpret because of conflicting findings, bias, and the need for further validation.^[1] Furthermore, randomized controlled trials, which are at the top of the hierarchy of evidence, are expensive, time-consuming, and limited in the surgical literature.^[2] Therefore, scientific reviews have become widely popular in the past two decades as they summarize and draw conclusions on clinically important issues from multiple studies.^[3]

Reviews can include narrative reviews, systematic reviews, and meta-analyses.^[4] Narrative reviews are concerned with summarizing a broad range of issues concerning a topic. In addition, the interpretation and conclusion of a narrative review often reflect the author's opinion; hence, such reviews are potentially biased, whereas, systematic reviews and meta-analyses are focused on applying a rigorous and comprehensive methodology to summarize, analyze, and interpret the evidence for a specific condition.

Over the past two decades, systematic reviews and meta-analyses have become increasingly prevalent in the orthopedic literature as they allow the pooling of the findings of multiple studies.^[3] Systematic reviews and meta-analyses are investigations aimed at answering a specific question by reviewing the current evidence through a multistage process.^[5] First, a specific question is formulated and usually is concerned with a specific population with the disease of interest, the primary exposure or treatment, the comparison exposure or treatment, and measurable outcomes. Second, inclusion and exclusion criteria are predefined to refine the validity of studies to be included in the review. Third, a comprehensive search of the literature is performed and studies matching the criteria are retrieved. Thereafter, the selected studies are assessed for methodological quality and bias using a standardized methodology. Finally, the data of interest are extracted, analyzed, and interpreted to reach a more valid conclusion. This multistage review process should be reproducible, thus making systematic reviews and meta-analyses more reliable in terms of results, interpretation, and conclusion. The validity of these reviews is made even more transparent by the guidelines of the preferred reporting items for systematic reviews and meta-analyses (PRISMA) statement,^[6] which consists of a 27-item checklist and four-phase flow diagrams. The aim of

the PRISMA statement is to assist authors in improving the reporting of systematic reviews and meta-analysis.

Systematic reviews are focused on implementing qualitative analyses, which are concerned with the methodological quality of the included studies by following a systematic and reproducible step-wise approach. Important examples of well-known orthopedic systematic reviews include the clinical practice guidelines of the American Academy of Orthopaedic Surgeons.^[7] These guidelines summarize the evidence of treatment approaches for different orthopedic conditions, which serve as an educational tool for physicians and guides management toward improved patient care.

Meta-analyses are considered as extensions of systematic reviews that use quantitative analysis. They are aimed at pooling the data from the included studies and investigating the relationships between multiple variables through statistical methods. Meta-analyses can demonstrate significant differences between interventions and outcomes which were not evident in each of the included studies alone. This is attributable to the increased statistical power due to combining results from multiple studies.^[8] An example of an important meta-analysis was reported by McKee *et al.* who investigated the operative versus non-operative treatment of midshaft clavicle fractures. They found no difference in long-term functional outcomes, despite some of the well-known studies included that advocated operative intervention to improve outcomes.^[9] Another example of an important meta-analysis is the study by Sukeik *et al.* on the use of tranexamic acid in total hip arthroplasty.^[10] After pooling the data from seven studies, the authors found that tranexamic acid significantly reduced blood loss both intra- and postoperatively without any increase in complications such as infection and thromboembolism.

It is important for orthopedic surgeons to bear in mind the limitations of systematic reviews and meta-analyses. If the included studies are of low-level evidence, poor methodological design, or underpowered, the review and/or meta-analysis is liable for increased risk of bias. Thus, one can consider systematic reviews and meta-analyses are as good as the studies they contain. In addition, a step-wise critical appraisal for systematic reviews or meta-analysis should be performed. One way to achieve this ascertainment of validity is provided by the Center of Evidence-Based Medicine in the form of a checklist of questions.^[11]

In conclusion, systematic reviews and meta-analysis are vital investigations for providing high-quality education and patient care that is reliant on the best available

evidence. However, orthopedic surgeons should be knowledgeable of the potential methodological limitations of these reviews and their included studies. We encourage orthopedic surgeons to explore the controversies in the orthopedic literature and aim at undertaking systematic reviews and meta-analyses, which may contribute to guideline development and policymaking.

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