Defining the Trajectory of Expertise: A Systematic Review of the Learning Curve in Male Functional Urology

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Background

The "learning curve" in surgical training, representing the progression of trainee efficiency and clinical outcomes, lacks a standardized definition and measurement, particularly challenging in the rapidly evolving field of male functional urology. Procedures like AUS implantation, male sling placement, bladder neck reconstruction, and penile prosthesis surgery demand significant technical skill and decision-making. This systematic review aimed to synthesize existing literature on the learning curve in male functional urology, identify factors impacting skill development, and quantitatively assess the number of cases needed for proficiency.
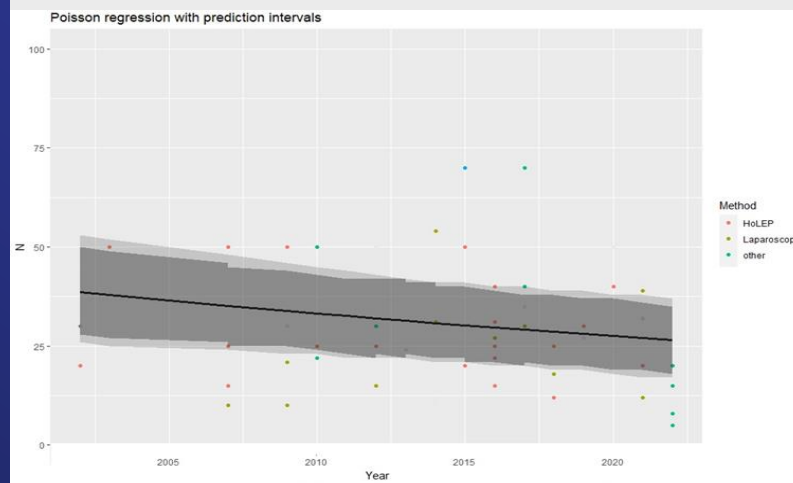

Methods

This systematic review, conducted in line with PRISMA, searched major databases for empirical studies on learning curves in male functional urology procedures. Eligible studies assessed outcomes such as operative time, complications, skill acquisition, and functional results, while non-original and simulation-only studies were excluded. Two reviewers independently screened, extracted data with a JBI tool, and appraised quality using JBI-MAStARI. Disagreements were resolved by discussion. A mixed-effects generalized linear regression with CUSUM analysis, adjusted for study year, was used to estimate the number of cases required to overcome the learning curve.

Results

The search yielded 7104 records, with 46 studies meeting inclusion criteria after full-text review of 185 articles. Most studies originated from France (N=8) and China (N=5). Publication years ranged from 2002 to 2023; all were observational. Common outcome measures were operative time, blood loss, and length of stay. Frequently studied procedures were HoLEP and urinary incontinence surgeries.
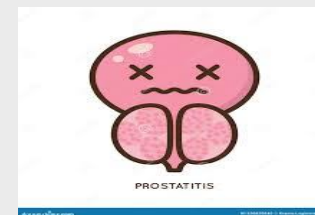
Learning Curve Estimates:

- Urinary Incontinence: ARGU Sling (SUI) ≈ 22 cases; AUS implantation ≈ 200 cases (N=65,602).

- Rectal Prolapse: Laparoscopic ventral mesh rectopexy 25-105 cases (5 studies); Robot-assisted ventral mesh rectopexy 18-55 cases (2 studies).

- Other Functional Urology: HoLEP 14-60 cases; ThuLEP 8-20 cases; RSCAI 5 cases; Robotic sacrocolpopexy 10-84 cases.

Quantitative analysis indicated a trend of decreasing cases needed to surpass the learning curve over time. Methodological quality varied across studies, with strengths in exposure and outcome assessment but weaknesses in handling confounding factors, follow-up, and statistical analysis.

Implications

Understanding the learning curve is crucial for optimizing surgical training and ensuring patient safety in male functional urology. This review provides valuable insights and underscores the need for ongoing research to refine training methodologies and competence assessment in this complex field.