



Preoperative Warm-up

In the Literature:

1. **The role of simulation and warm-up in minimally invasive gynecologic surgery; Moulder JK, Louie M, Toubia T, Schiff LD, Siedhoff MT; Curr Opin Obstet Gynecol. 2017 Aug;29(4):212-217.**
 “Simulation-based curricula may be a useful adjunct to residency training, whereas warm-up and surgical coaching may allow for maintenance of skill throughout a surgeon's career. These experiences may represent a strategy for maintaining quality and value in a lower volume surgical setting.”
2. **Warming up with endotrainer prior to laparoscopic cholecystectomy. [Article in Spanish]; Troncoso-Bacelis A, Soto-Amaro J, Ramírez-Velázquez C.; Cirugía y Cirujanos. 2017 Jul - Aug;85(4):299-305.**
 “CONCLUSION: Performing warm up on a MISTELS system endotrainer before performing laparoscopic cholecystectomy reduces the operating time of surgery for all surgeons.”
3. **A systematic examination of preoperative surgery warm-up routines; Pike TW, Pathak S, Mushtaq F, Wilkie RM, Mon-Williams M, Lodge JPA; Surg Endosc. 2017 May;31(5):2202-2214.**
 “While the reviewed studies had a number of methodological issues, the global data indicate that preoperative simulation has substantial potential to improve surgical performance.”
4. **Preoperative Practice Paired With Instructor Feedback May Not Improve Obstetrics-Gynecology Residents' Operative Performance; Kroft J, Ordon M, Po L, Zwingerman N, Waters K, Lee JY, Pittini R.; J Grad Med Educ. 2017 Apr;9(2):190-194.**
 “This study suggests that a surgical preoperative practice with instructor feedback may not improve operative technique compared to either preoperative practice or feedback alone.”
5. **Does Warm-Up Training in a Virtual Reality Simulator Improve Surgical Performance? A Prospective Randomized Analysis; da Cruz JAS, Dos Reis ST, Cunha Frati RM, Duarte RJ, Nguyen H, Srougi M, Passerotti CC.; J Surg Educ. 2016 Nov - Dec;73(6):974-978.**
 “CONCLUSION: The practice of preoperative warm-up training seems to benefit surgical performance even in subject with mild laparoscopic experience.”
6. **Effect of Preoperative Warm-up Exercise Before Laparoscopic Gynecological Surgery: A Randomized Trial; Polterauer S, Husslein H, Kranawetter M, Schwameis R, Reinhaller A, Heinze G, Grimm C.; J Surg Educ. 2016 May-Jun;73(3):429-32.**
 “The present study suggests that warm-up before laparoscopic salpingo-oophorectomy does not increase psychomotoric skills during surgery. Moreover, it does not influence operating time and complication rates.”
7. **Improving procedural performance through warm-up and mental imagery; Weller JM; British Journal of Anaesthesia. 2016 Mar;116(3):315-7.**
 “Warming up prior to a race or a musical performance is established practice and supported by a wealth of evidence. The similarities between athletic or artistic performance and the performance of a surgeon embarking on a complex surgical procedure prompted exploratory research of the value of warmup in surgery. There are now numerous randomized controlled



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trials (RCTs) exploring the effect of a pre-procedural warm-up for laparoscopy on a virtual reality simulator.”

“The type of warm-up seems to be important, and may vary across different contexts... Most research has focused on laparoscopic or endoscopic procedures requiring particular navigational skills, hand–eye coordination, or coping with the fulcrum effect of laparoscopic instruments passing through the abdominal wall.”

“Performing the whole procedure may not be as useful as practicing specific tasks and may introduce an element of fatigue.”

8. **Simulation as a set-up for technical proficiency: can a virtual warm-up improve live fibre-optic intubation?; Samuelson ST, Burnett G, Sim AJ, Hofer I, Weinberg AD, Goldberg A, Chang TS, DeMaria S Jr.; Br J Anaesth. 2016 Mar;116(3):398-404.**

“Virtual warm-up significantly improved performance by residents of FOI (Fibre-optic intubation) in live patients with normal airway anatomy, as measured both by speed and by a scaled evaluation of skills.”

9. **Does warming up improve surgical outcome in total hip arthroplasty?; Makhdom AM, Almaawi A, Tanzer D, Tanzer M.; Eur J Orthop Surg Traumatol 2015 Dec; 25: 1265–9.**

“CONCLUSION: Warming up prior to performing surgery does not make a difference for primary THA (total hip arthroplasty) when performed by an experienced surgeon. However, these results may not reflect its effect on procedures that require fine motor skills or done by an orthopedic trainee or less experienced surgeons.”

10. **The effect of warm-up on surgical performance: a systematic review; Abdalla G, Moran-Atkin E, Chen G, Schweitzer MA, Magnuson TH, Steele KE; Surg Endosc. 2015 Jun;29(6):1259-69.**

“All included studies were randomized with half of them being randomized controlled studies and the rest randomized crossover studies. The total number of operative cases was 196, including 98 warm-up and 98 non warm-up. The total number of participants was 87, with the largest number in a single study being 38 and the average sample size of all studies was 14. All six studies assessed various aspects of laparoscopic surgical performances. Significant improvement in the intraoperative laparoscopic performance was observed with warming-up preoperatively in five out of six studies ($p < 0.05$).”

11. **Preoperative warmup the key to improved resident technique: a randomized study; Erin Moran-Atkin, Gamal Abdalla, Grace Chen, Thomas H. Magnuson, Anne O. Lidor, Michael A. Schweitzer & Kimberley E. Steele; Surg Endosc 2015 May; 29: 1057–63.**

“Preoperative warm-up significantly improves depth perception, bimanual dexterity, and efficiency of movements, as well as improvement in composite scores as judged by the attending surgeon.” [using an FLS box trainer]

12. **Effect of different warm-up strategies on simulated laparoscopy performance: a randomized controlled trial.; Brönnimann E, Hoffmann H, Schäfer J, Hahnloser D, Rosenthal R.; J Surg Educ. 2015 Jan-Feb;72(1):96-103.**

“CONCLUSIONS: We were unable to show an effect of the 2 tested warm-up strategies on VR performance in laypersons. We are currently designing a follow-up study including surgeons



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rather than laypersons with a longer warm-up exercise, which is more closely related to the final task.”

- 13. Improving clinical performance using rehearsal or warm-up: an advanced literature review of randomized and observational studies; O'Leary JD, O'Sullivan O, Barach P, Shorten GD.; Acad Med. 2014 Oct;89(10):1416-22.**

“Preliminary findings suggest that preoperative rehearsal or warm-up can improve the performance of operators or operating teams, but there is a paucity of objective evidence and comparative clinical studies in the existing literature to support their routine use.”

- 14. Short-duration virtual reality simulation training positively impacts performance during laparoscopic colectomy in animal model: results of a single-blinded randomized trial: VR warm-up for laparoscopic colectomy; Araujo SE, Delaney CP, Seid VE, Imperiale AR, Bertocini AB, Nahas SC, Cecconello I; Surg Endosc. 2014 Sep;28(9):2547-54.**

“Surgeons undergoing short-duration training on the VR simulator performed significantly better during laparoscopic colectomy on the pig regarding general and specific technical skills evaluation.”

“A single short-duration VR simulator practice positively impacted surgeons' generic and specific skills performance required to accomplish laparoscopic colectomy in the swine model.”

- 15. Warm-up before laparoscopic surgery is not essential; Weston MK, Stephens JH, Schafer A, Hewett PJ.; ANZ J Surg. 2014 Mar;84(3):143-7.**

“This study suggests that warm-up prior to laparoscopic cholecystectomy or appendectomy is not essential, acknowledging that there are several study limitations that preclude definitive conclusion.”

- 16. Warm-up on a simulator improves residents' performance in laparoscopic surgery: a randomized trial; Chen CC, Green IC, Colbert-Getz JM, Steele K, Chou B, Lawson SM, Andersen DK, Satin AJ; Int Urogynecol J. 2013 Oct;24(10):1615-22.**

“Residents who performed warm-up exercises prior to surgery were rated significantly higher on all subscales within each global rating scale, irrespective of the difficulty of the surgery. Most residents felt that performing warm-up exercises helped their intraoperative performances.”

“CONCLUSION: Performing a brief warm-up exercise before a major or minor laparoscopic procedure significantly improved the intraoperative performance of residents irrespective of the difficulty of the case”

- 17. Virtual reality robotic surgery warm-up improves task performance in a dry laboratory environment: a prospective randomized controlled study; Lendvay TS, Brand TC, White L, Kowalewski T, Jonnadula S, Mercer LD, Khorsand D, Andros J, Hannaford B, Satava RM.; J Am Coll Surg. 2013 Jun;216(6):1181-92.**

“RESULTS: Task time, path length, and cognitive errors were reduced in the warm-up group compared with the control group for similar tasks. Global technical errors in intracorporeal suturing were reduced after the dissimilar VR task. When surgeons were stratified by earlier robotic and laparoscopic clinical experience, the more experienced surgeons (n = 17) demonstrated significant improvements from warm-up in task time and economy of motion,



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and improvement in these metrics was not statistically significantly appreciated in the less-experienced cohort (n = 34).”

“CONCLUSIONS: We observed significant performance improvement and error reduction rates among surgeons of varying experience after VR warm-up for basic robotic surgery tasks. In addition, the VR warm-up reduced errors on a more complex task (robotic suturing), suggesting the generalizability of the warm-up.”

18. **Does surgical "warming up" improve laparoscopic simulator performance?; Kroft J, Ordon M, Arthur R, Pittini R.; Simul Healthc. 2012 Dec;7(6):339-42.**

“This study demonstrates that a preoperative warm-up, combined with repetition, is beneficial in improving senior obstetrics and gynecology residents' laparoscopic suturing performance.”

19. **Preoperative warming up exercises improve laparoscopic operative times in an experienced laparoscopic surgeon; Mucksavage P, Lee J, Kerbl DC, Clayman RV, McDougall EM; J Endourol. 2012 Jul;26(7):765-8.**

“Performing warm-up exercises before complex laparoscopic surgery may improve operative times and performance in the operating room, especially for complex laparoscopic surgeries.”

20. **Simulated procedure rehearsal is more effective than a preoperative generic warm-up for endovascular procedures; Willaert WI, Aggarwal R, Daruwalla F, Van Herzeele I, Darzi AW, Vermassen FE, Cheshire NJ, European Virtual Reality Endovascular Research Team EVEReST; Ann Surg. 2012 Jun;255(6):1184-9.**

“CONCLUSIONS: Patient-specific simulated rehearsal of a CAS procedure significantly improves operative performance, compared to a generic VR warm-up or no warm-up. This technology requires further investigation with respect to improved outcomes on patients in the clinical setting.”

21. **Laparoscopic Warm-up Exercises Improve Performance of Senior-Level Trainees During Laparoscopic Renal Surgery; Jason Y. Lee, Phillip Mucksavage, David C. Kerbl, Kathryn E. Osann, Howard N. Winfield, Kanav Kahol, Elspeth M. McDougall; J Endourol. 2012 May; 26(5): 545–550.**

“Cognitive and psychomotor performance (attention, distraction, workload, spatial reasoning, movement smoothness, posture stability) were found to be significantly better in the +POWER (preoperative warm-up exercise routine) group (P = 0.05)”

“Urologic trainees who perform a POWER approximately 1 hour before laparoscopic renal surgery demonstrate improved cognitive, psychomotor, and technical performance.”

22. **Preoperative warm-up using a virtual reality simulator; Moldovanu R, Târcoveanu E, Dimofte G, Lupașcu C, Bradea C; JSLS. 2011 Oct-Dec;15(4):533-8.**

“Surgeons, even the most experienced in laparoscopic surgery, can increase specific psychomotor skills associated with a laparoscopic environment by doing simple exercises on a virtual reality simulator, just before an operation. These improvements are reflected in more accurate handling of tissue during laparoscopic cholecystectomy.”

“Surgeons can increase specific psychomotor skills associated with a laparoscopic environment by doing simple exercises on a virtual reality simulator, just before an operation.”



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23. **Another use of the mobile device: warm-up for laparoscopic surgery; Plerhoples TA, Zak Y, Hernandez-Boussard T, Lau J.; J Surg Res. 2011 Oct;170(2):185-8.**

“CONCLUSIONS: Warm-up using a mobile device balance game decreases errors on basic tasks performed on a laparoscopic surgery simulator, suggesting a practical way to warm-up prior to cases in the operating room.”

24. **Warm-up in a virtual reality environment improves performance in the operating room; Calatayud D, Arora S, Aggarwal R, Kruglikova I, Schulze S, Funch-Jensen P, Grantcharov T; Ann Surg. 2010 Jun, 251(6):1181-5.**

“CONCLUSION: This study showed a significant beneficial impact of warm-up on laparoscopic performance in the OR. The suggested program is short, easy to perform, and therefore realistic to implement in the daily life in a busy surgical department. This will potentially improve the procedural outcome and contribute to improved patient safety and better utilization of OR resources.”

25. **Effect of Short-Term Pretrial Practice on Surgical Proficiency in Simulated Environments: A Randomized Trial of the “Preoperative Warm-Up” Effect; Kanav Kahol, Richard M. Satava, John Ferrara, Marshall L. Smith; JACS February 2009, Volume 208, Issue 2, Pages 255–268.**

“Surgery is a skill-driven discipline. While other high-stake professions with comparable cognitive and psychomotor skill requirements often use warm-up exercises for achieving better proficiency, the effects of such practice have not been investigated sufficiently in surgical tasks.”

“Results: All outcomes measures demonstrated statistically significant improvements after all of the post-warm-up exercises ($p < 0.01$), and were seen in all groups with differing experience levels.”

“Conclusion: Preoperative warm-up for 15 to 20 minutes with simple surgical exercises leads to a substantial increase in surgical skills proficiency during followup tasks.”

26. **A warm-up laparoscopic exercise improves the subsequent laparoscopic performance of Ob-Gyn residents: a low-cost laparoscopic trainer; Do AT, Cabbad MF, Kerr A, Serur E, Robertazzi RR, Stankovic MR; JSLS. 2006 Jul-Sep;10(3):297-301.**

“CONCLUSION: A brief warm-up exercise before an actual laparoscopic surgical procedure significantly improves subsequent laparoscopic performance.”