RETRACTED: Commentary: Computational Analysis for ERAS and Other Surgical Processes: Commentary From Clinical Perspective

Hilla Mills[1]*, Ronald Acquah[1], Nova Tang[2], Luke Cheung[2]*, Susanne Klenk[3], Ronald Glassen[3]*, Magali Pirson[4], Alain Albert[4]*, Duong Trinh Hoang[5] and Thang Nguyen Van[5]*

[1]Department of Medical Science, University for Development, Accra, Ghana, [2]RD Lab, The Hospital Institute for Hebal Research, Toluca, Mexico, [3]Research Institute of Clinical Biomedicine, Hospital University Medical Centre, Ulm, Germany, [4]Industrial Research Group, International College of Science and Technology, Brussels, Belgium, [5]Clinical Analysis Lab, Center of Bio-Medicine, Hanoi, Vietnam

A Commentary on

Computational Analysis for ERAS and Other Surgical Processes: Commentary From Clinical Perspective

Nowadays, many diseases need to be treated or diagnosed by surgery (1). Surgical treatment can produce better improvement on body function of patients compared with non-surgical treatment (2). However, surgery often result in a high complication rate, which will affect postoperative recovery and lengthen hospital stay (3, 4). In addition, surgery usually results in psychological problems of patients such as anxiety and depression (5, 6). Therefore, an optimized nursing method with physiological and psychological care is required for patients (7, 8).

The theory of enhanced recovery after surgery (ERAS) was first proposed by Kehlet (9), which refers to a standardized method of perioperative nursing and a multi-mode approach that combines preoperative and postoperative nursing methods to reduce the stress associated with surgery, thus allowing for accelerated recovery after surgical treatment (10). ERAS nursing has been proved to be a beneficial way of improving patients' function (11). A large amount of evidences have shown that ERAS pathway can bring various positive effects, including reduce complication rate after surgery and the risk of death, decreasing readmission rate, length of stay and hospitalization expenses (12, 13). Kobayashi's study indicated that the implement of ERAS pathways can reduce the probability of postoperative complication for each surgical complexity of liver resection of patients (14). Fay and Gwacham's research have proved that the use of ERAS protocol was associated with significant decrease in hospital stay and discharge expenses (15, 16). It is reported that following ERAS nursing has been proved a better improvement in patients' psychological status and their quality of life (17, 18). The research results of Li and her team about ERAS nursing are presented in **Table 1**, which are consistent with the previous studies.

Statistically, $p < 0.05$ means that the result is statistically meaningful, and $p < 0.01$ means that there is significant difference. This study proved ERAS pathways to be an effective way to improve patients'

TABLE 1 | Statistical results of different research contents.

Research contents	ERAS nursing	Routine nursing	Statistical value
Postoperative complications rate (%)	7.22	19.44	$p < 0.01$**
Anal exhaust time (h)	33.30 ± 3.26	64.50 ± 3.28	$p < 0.05$*
free movement time out of bed (h)	19.80 ± 4.26	33.72 ± 2.32	$p < 0.05$*
Average length of hospital stay (d)	9.07 ± 1.26	18.01 ± 2.26	$p < 0.05$*
Degree of satisfaction (%)	98.30	85.00	$p < 0.05$*
Quality of life (including 7 items)	–	–	$p < 0.01$**

*$p < 0.05$; **$p < 0.01$.

recovery and their quality of life by using a computational statistical analysis, which inspired us to realize more about the application of computer in surgical engineering.

With the rapid development of computer, especially the popularity of microcomputers, computer technology has penetrated into almost all fields of medicine and its management (19). In ERAS nursing pathways and surgical process, computers can be used to obtain, store, transmit, process and utilize all kinds of information about medicine and medical management. It can be also used for patients' registration and appointment, medical record management, ward management, clinical monitoring, dietary management, health examination registration, patient checkout and discharge, medical assistant diagnosis and decision-making (20, 21).

General surgical process includes the registration of patients' medical records, hospital information management, computer-aided diagnosis, etc., which can be quickly and conveniently realized by computer technology and have been widely used in medical management. Electronic medical records are the computerization of traditional medical record, which are rapidly replacing the original handwritten medical record to use memory cards, computers and other electronic facilities to store, query and refine the diagnosis and treatment process of patients in surgery (22). Its convenience in inputting, sharing and storing information make it into the priority for hospitals (23). Hospital information systems refer to a comprehensive and integrated computer network system that supports the collection and management of massive hospital information (24). Computer-aided diagnosis and decision-making system (CAD&CMD) can help doctors shorten the diagnosis time, avoid omissions, reduce labor intensity and refer to other

experts' opinions, so as to make a diagnosis as soon as possible and propose a treatment plan (25).

Computer also plays an important role in nursing work. The application of computer in nursing work is mainly divided into three aspects: (1) Nursing, including nursing records, nursing examination, patient monitoring, drug management, etc. (2) Nurse education, including nursing education, nursing teaching plan and management of academic record. (3) Nurse management, including the scheduling of nurse service plan, human resource management, and the inspection or appraisal of nurses' work quality (26, 27, 28). These can be massively used in ERAS nursing process.

For medical stuff, a lot of information needs to be processed in clinical research, experimental research and epidemiological investigation. The application of computer can calculate and process these data accurately and quickly. For this purpose, various computer languages such as SAS, SPSS, SYSTAT and RDAS have been developed by many software packages, of which one of the most commonly used software is SPSS (29, 30, 31).

In recent years, computer technology has been applied in more and more fields of medicine, which has become a hot research object and widely concerned. With the development of computer technology in the medical field, computers play an irreplaceable role in medical research, clinical diagnosis and treatment, pharmacological studies and molecular interactions (32, 33). The application of computer in perioperative period and surgical nursing is constantly maturing, which greatly improves the working efficiency of medical staff. Although this article only shows a small part of the application of computer technology in medicine, Li and her team's research inspired the thinking about computational analysis in medical field and aroused our attention to more application of computer technology in medicine, which provide a good reference for further research of computational analysis on surgery.

AUTHOR CONTRIBUTIONS

HM and RA contributed to conception and design of the study, and wrote the first draft of the manuscript. NT, LC, SK, RG, MP, AA, DTH and TNV contribute to the data collection and analysis. All authors approved the submitted version. All authors contributed to the article and approved the submitted version.

ACKNOWLEDGMENTS

REFERENCES

1. Matsuo K, Klar M, Ciccone MA, Nusbaum DJ, Shimada M, Roman LD, et al. Incorporation of sentinel lymph node biopsy in cervical cancer surgery: recent U.S. trends. *Eur J Surg Oncol.* (2022) S0748-7983(22)00112-3. [Epub ahead of print]

2. Jia Y, Peng Z, Qin Y, Wang G. Surgical versus nonsurgical treatment for adult spinal deformity: a systematic review and meta-analysis. *World Neurosurg.* (2022) 159:1–11. doi: 10.1016/j.wneu.2021.12.017

3. Smith JS, Klineberg E, Lafage V, Shaffrey CI, Schwab F, Lafage R, et al. Prospective multicenter assessment of perioperative and minimum 2-year

postoperative complication rates associated with adult spinal deformity surgery. *Br J Neurosurg Spine*. (2016) 25(1):1–14. doi: 10.3171/2015.11. SPINE151036

4. Rahm C, Adok C, Dahm-Kähler P, Bohlin KS. Complications and risk factors in vulvar cancer surgery – a population-based study. *Eur J Surg Oncol*. (2022) S0748-7983(22)00079-8. [Epub ahead of print]

5. Gravel V, Boucher O, Citherlet D, Hébert-Seropian B, Bouthillier A, Nguyen DK. Psychological status after insulo-opercular resection in patients with epilepsy: depression, anxiety, and quality of life. *Epilepsy Behav*. (2021) 118:107919. doi: 10.1016/j.yebeh.2021.107919

6. Moisak GI, Amelina EV, Zubok NA, Rzaev JA. Psychological status before and after surgery in patients with trigeminal neuralgia. *Clin Clin Neurol Neurosurg*. (2021) 203:106578. doi: 10.1016/j.clineuro.2021.106578

7. Sanson G, Vellone E, Kangasniemi M, Alvaro R, D'Agostino F. Impact of nursing diagnoses on patient and organisational outcomes: a systematic literature review. *J Clin Nurs*. (2017) 26(23–24):3764–83. doi: 10.1111/jocn. 13717

8. Adugbire BA, Aziato L, Dedey F. Patients' experiences of pre and intra operative nursing care in Ghana: A qualitative study. *Int J Africa Nurs Sci*. (2017) 6:45–51. doi: 10.1016/j.ijans.2017.04.001

9. Kehlet H. Multimodal approach to control postoperative pathophysiology and rehabilitation. *Br J Anaesth*. (1997) 78(5):606–17. doi: 10.1093/bja/78.5.606

10. Greisman JD, Olmsted ZT, Crorkin PJ, Dallimore CA, Zhigin V, Shlifer A, et al. Enhanced recovery after surgery (ERAS) for cranial tumor resection: a review. *World Neurosurg*. (2022) S1878-8750(22)00409-0. https://doi.org/10. 1016/j.wneu.2022.03.118. [Epub ahead of print]

11. Ljungqvist O, Scott M, Fearon KC. Enhanced recovery after surgery: a review. *JAMA Surg*. (2017) 152(3):292–8. doi: 10.1001/jamasurg.2016.4952

12. Ali ZS, Ma TS, Ozturk AK, Malhotra NR, Schuster JM, Marcotte PJ, et al. Pre-optimization of spinal surgery patients: development of a neurosurgical enhanced recovery after surgery (ERAS) protocol. *Clin Neurol Neurosurg*. (2018) 164:142–53. doi: 10.1016/j.clineuro.2017.12.003

13. Lu Y, Yuan Z, Han Y, Zhang Y, Xu R. Summary of best evidence for enhanced recovery after surgery for patients undergoing lung cancer operations. *Asia-Pacific J Oncol Nurs*. (2022) 9(7):100054. doi: 10.1016/j. apjon.2022.03.006

14. Kobayashi K, Kawaguchi Y, Schneider M, Piazza G, Labgaa I, Joliat GR, et al. Probability of postoperative complication after liver resection: stratification of patient factors, operative complexity, and use of enhanced recovery after surgery. *J Am Coll Surg*. (2021) 233(3):357–68. doi: 10.1016/j.jamcollsurg. 2021.05.020

15. Fay EE, Hitti JE, Delgado CM, Savitsky LM, Mills EB, Slater JL, et al. An enhanced recovery after surgery pathway for cesarean delivery decreases hospital stay and cost. *Am J Obstet Gynecol*. (2019) 221(4):349.e1–349.e9. doi: 10.1016/j.ajog.2019.06.041

16. Gwacham NI, Cinicolo L. Implementation of enhanced recovery after surgery in gynecologic oncology surgery at a major teaching community hospital improves quality, decreases hospital stay, and cost. *Gynecol Oncol*. (2019) 154(1):190–1. doi: 10.1016/j.ygyno.2019.04.430

17. Kilpiö O, Härkki PSM, Mentula MJ, Pakarinen PI. Health-related quality of life after laparoscopic hysterectomy following enhanced recovery after surgery protocol or a conventional recovery protocol. *J Minim Invasive Gynecol*. (2021) 28(9):1650–5. doi: 10.1016/j.jmig.2021.02.008

18. Yu Y, Li M, Kang R, Liu X, Wang N, Zhu Q, et al. The effectiveness of telephone and internet-based supportive care for patients with esophageal cancer on enhanced recovery after surgery in China: a randomized controlled trial. *Asia-Pacific J Oncol Nurs*. (2022) 9(4):217–28. doi: 10. 1016/j.apjon.2022.02.007

19. Allen R. A distributed computer network using microcomputers for on-line data processing in clinical monitoring and medical research. *J Biomed Eng*. (1980) 2(4):299–304. doi: 10.1016/0141-5425(80)90124-7

20. Guan S, Wang Z, Ma H, Liu Y. Computer aided embedded medical system and clinical treatment effect of heart failure based on clinical data. *Microprocessors Microsyst*. (2021) 81:103702. doi: 10.1016/j.micpro.2020.103702

21. Polat K, Güneş S. Computer aided medical diagnosis system based on principal component analysis and artificial immune recognition system classifier algorithm. *Expert Syst Appl*. (2008) 34(1):773–9. doi: 10.1016/j. eswa.2006.10.011

22. Cummings E, Moran G, Woods L, Almond H, Procter P, Makeham M, et al. Methodology for the development of the Australian national nursing and midwifery digital health capability framework. *Stud Health Technol Inform*. (2021) 284:135–42. doi: 10.3233/SHTI210685

23. Najjar A, Amro B, Macedo M. The adoption level of electronic medical records in hebron hospitals based on the electronic medical record adoption model (EMRAM). *Health Policy Technol*. (2021) 10(4):100578. doi: 10.1016/j.hlpt.2021.100578

24. Liang C, Gu D, Tao F, Jain HK, Zhao Y, Ding B. Influence of mechanism of patient-accessible hospital information system implementation on doctor–patient relationships: a service fairness perspective. *Info Manage*. (2017) 54 (1):57–72. doi: 10.1016/j.im.2016.03.010

25. Sun J, Huang Y. Computer aided intelligent medical system and nursing of breast surgery infection. *Microprocess Microsyst*. (2021) 81:103769. doi: 10.1016/j.micpro.2020.103769

26. Liesveld J, Petrovic K, León T, Grohman S, Wright M. Nursing education: from classroom to computers – The New Mexico Nursing Education Consortium's collaborative problem solving during the pandemic. *J Prof Nurs*. (2021) 37(5):928–34. doi: 10.1016/j.profnurs.2021.07.012

27. Choi H, Lee U, Gwon T. Development of a computer simulation-based, interactive, communication education program for nursing students. *Clin Simul Nurs*. (2021) 56:1–9. doi: 10.1016/j.ecns.2021.04.019

28. Li Z, Dong Y, He C. Computer aided medical system design and clinical nursing intervention for infantile pancreatitis. *Microprocessors Microsyst*. (2021) 81:103761. doi: 10.1016/j.micpro.2020.103761

29. Plume ML. SPSS (Statistical Package for the Social Sciences). *Encyclopedia Inf Syst*. (2003) 4:187–96. doi: 10.1016/B0-12-227240-4/00166-0

30. Bierbaum TJ, Case MA, Weston PA, Bush GL, Pham T. Behavior recorder: software to record and analyze behavioral data using SAS and SYSTAT statistical software. *Comput Electron Agric*. (2000) 29(3):233–41. doi: 10. 1016/S0168-1699(00)00145-9

31. Maric M, de Haan E, Hogendoorn SM, Wolters LH, Huizenga HM. Evaluating statistical and clinical significance of intervention effects in single-case experimental designs: an SPSS method to analyze univariate data. *Behav Ther*. (2015) 46(2):230–41. doi: 10.1016/j.beth.2014.09.005

32. Bing P, Zhou W, Tan S. Study on the mechanism of astragalus polysaccharide in treating pulmonary fibrosis based on "Drug-Target-Pathway" network. *Front Pharmacol*. (2022) 13:865065. doi: 10.3389/fphar.2022.865065

33. Tan S, Wang D, Chi Z, Li W, Shan Y. Study on the interaction between typical phthalic acid esters (PAEs) and human haemoglobin (hHb) by molecular docking. *Environ Toxicol Pharmacol*. (2017) 53:206–11. doi: 10. 1016/j.etap.2017.06.008