

Clinical management IT system for enhanced recovery

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Abstract: Surgical resection has a key role for the treatment of early stage lung cancer along with certain advanced cases, and minimally invasive techniques, representatively video-assisted thoracoscopic surgery (VATS), are becoming standard for lung cancer surgery. Implementation of integrated programs which could manage the whole process of patient treatment including preoperative, intraoperative and postoperative care is thought to be essential partner for successful application of minimally invasive thoracic surgery for lung cancer treatment. Enhanced recovery after surgery (ERAS), so called “fast-track” programs pursue the adequate and efficient delivery of health care services therefore to improve postoperative outcomes and reduce medical cost. Well-organized information technology systems would be helpful to achieve the goals of ERAS without increasing the burden of budget or working staffs. Furthermore, it could contribute to create knowledge and translate to the clinical process.

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Introduction

Obviously, surgical resection is main stream for cancer treatment (1-4). Reducing undesirable sequelae after surgery is important for improvement of clinical outcomes (5). Postoperative complications, such as pain, cardiopulmonary dysfunction, infection or thromboembolism are usually associated with anesthesia and surgical skills. However, despite the gradual advances in these fields, postoperative morbidities still remains major concerns for cancer surgeries (6).

Professor Henrik Kehlet had understood that the undesirable results after surgery could be caused by the surgical stress responses, which resulted in trauma-induced endocrine metabolic changes and activation of several biological cascade systems (7). These reactions probably were designed to contribute to survival advantages, rather in certain conditions, lead to catastrophic adverse effects. Therefore, in addition to the development of anesthesia

and surgical techniques, modification of stress responses followed by trauma-induced metabolic cascades should be added to decrease negative surgical outcomes (6,7).

Traditional single modality methods seemed not to afford to solve these problems (7). Factors suspected to cause surgical stress responses are not limited to the intraoperative components. Pre-existing concomitant disease and lifestyle of patients, preoperative management such as bowel preparation nil per os (NPO), or intravascular fluid administration, postoperative unpleasant symptoms such as pain, nausea or prolonged NPO, are all potential causes for stress metabolic responses after surgery. Multidisciplinary approach combined with multi-modality therapeutic strategies could be the solution (7).

Each single modality regimen joined with multi-modality programs should be supported by scientific evidence (8). Before the application of multi-modality

therapy, standardization and consensus by the specialists in each compartment should be preceded. Establishment of evidence-based protocols and clinical implementation is an enormous work (6). It might be impossible if we should perform this project only with our own head and hands.

Healthcare information technology (HIT), as an integrated program for health care provision, is an essential partner for the multi-modality treatment strategies (9). Adoption of HIT platform with well clinically adjusted protocols could make it possible to improve treatment goal effectively without increasing cost and work burden of staffs. Without the support of HIT, enhanced recovery after surgery (ERAS) cannot be properly operated.

ERAS, concept and pathway

Since Professor Henrik Kehlet first suggested the concept of ERAS in early 1990's, multi-modality therapeutic regimens based on this has been widely used not only in the colorectal surgery by which this concept was firstly adopted, also other surgical area such as urogenital surgery or thoracic surgery (1-4).

The purposes of ERAS clinical protocols are to relief surgical stress and reduce undesirable complications, thereby to reach optimal postoperative outcomes. To achieve these, ERAS protocols adopt potential items of pre-, intra- and postoperative periods inside their systems so that they could modify the possible threat (6).

Because factors which should be dealt with ERAS system are enormous, cooperative works between specialist groups are inevitable. Multidisciplinary collaborations are necessary for enrollment of evidence-proved modalities, establishment of protocols with consensus, implementation of this to clinical practice, assessment of the effectiveness or revision (8).

Multidisciplinary team work

The collaboration between treatment groups associated with patients treatment is one of the major challenges in ERAS composition. Specialists for ERAS comprise anesthesiologists, surgeons, physicians, nurses, dietitians, out-patient department and rehabilitation institutions (7,10). They should be educated for the ERAS concepts and procedures. They also should be encouraged to propose answers for how to adapt ERAS protocols to actual clinical practice (11). Coordinated multidisciplinary discussion is important because it is needed for participation of health information technologists (9).

Enrollment of evidence-based modality

Each single-modality which wishes to join the ERAS protocols should demonstrated its efficacy by the scientific evidences (7). Preoperative fasting over midnight or postoperative prolong resting had been traditional perioperative care methods, but now they has not been supported by scientific data, they are recommended no longer. Once one strategy was involved in ERAS protocols, it could be expelled when it cannot acquire scientific evidence (8).

Standardization of protocols

Although there has been increasing application, standardization is still a weak point of ERAS protocols. Numerous studies have been demonstrated better postoperative outcomes compared with conventional postoperative care and safety of ERAS protocols, these results were based on different composition of ERAS protocols (12). Efforts to summarize core protocol elements have been attempted continuously through the systemic meta-analyses. However, there are still no clearly defined common ERAS protocols (6).

Adaptation to the clinical practice

Compliance of doctors with ERAS protocols is important factors for clinical application. Some studies showed that high compliance with ERAS protocols were correlated with improved postoperative outcomes (13). Practitioners who are expected to participate in ERAS programs are recommended to be educated the concepts and principles of ERAS (5). How they deeply understand seemed to be directly connected with the successful management of ERAS. Patient education also could facilitate the ERAS application. Teaching for exercise, physiotherapy device, or smoking cessation for patients who are scheduled for surgery could contribute to the postoperative outcomes (10).

Assessment of impact and amendment of protocols

Clinical outcomes of ERAS protocols should be assessed using proper evaluation tools. Because there are always lacks of evidences proved by randomized controlled trials (RCTs), appropriate assessment tools for evaluating impact are important. Postoperative complication frequency, pain scale and length of hospital stay are well known indicators. Results from assessment should be debated among the

multidisciplinary team and reflected the conclusion to the protocols (4,6).

ERAS integrated with health information technology

To perform the complicate process of ERAS including selection of protocol items, organization, clinical application, analysis of outcomes, and feedback, application of HIT is inevitable. Actually, without the HIT systems, implementation of ERAS protocols might be impossible (14).

HIT, in other ward, biomedical and health informatics, means any fusion of electronic information processing with medical area. In narrow sense, HIT means electronic health records, computerized provider order entry (9). Besides the substitution for paper-based information management, it comprises complex information activities including healthcare delivery, medical research, integrating new scientific evidence to clinical practice and so on (15).

The benefit of HIT on clinical application has been well understood by policymakers, administrators, clinicians and healthcare consumes, however, adaptation of HIT to health care industry has been proven to be difficult and limited to use. Theoretical advantages seldom have been demonstrated in real healthcare environment, and the cost for development of practical HIT often exceeds the expected benefit (9).

Therefore, compromises between the ideal healthcare information systems and practical needs are necessary. Health care technology in early days had been just substitution for paper-based healthcare delivery systems. In recent decades, they have combined with enhanced recovery, so called, fast-track or clinical pathway protocols. Accompanied by the advances of information management techniques, HIT has have extraordinary power of data processing and translation them to new knowledge. It would make healthcare providers can revise clinical practice with new evidence more easily, however, it might increase cost for development of information systems for hospital (16).

Appropriately developed commercial healthcare systems should be demonstrated that they can increase adherence to guideline-based care, enhance surveillance and monitoring, and decrease medication errors. In addition to this, updated healthcare systems should have interface with patients for education and feedback (9).

Clinical patients care systems

The basic function of clinical patient care system is to delivery

medical services which had been performed by paper. For more effectiveness, combination with enhanced recovery protocols is necessary (17). Evidence based clinical patients care systems comprise three compositions, (I) clinical decision support systems; (II) clinical pathway, so called “fast-track” protocols; and (III) translated information such as clinical indicators. Goals of this system are to secure patient safety, standardization of clinical practice, and quality control (18).

Clinical decision support system (CDSS) is an integrated intelligence system based on the patient electronic medical record, which provides clinicians, staff, patients, and other individuals with knowledge and person-specific information, intelligently filtered and presented at appropriate times, to enhance health and health care (17).

The major purpose of CDSS is to satisfy clinical needs, including confirming accurate diagnosis, preventing adverse drug events, or screening predictable nursing errors. In each stage of clinical process, CDSS can provide services as follows (19):

- (I) Preventive care: immunization, screening, disease management guidelines for secondary prevention;
- (II) Diagnosis: suggestion for possible diagnosis for each patient;
- (III) Treatment: treatment guidelines for specific diagnoses, drug dosage recommendations, alter for drug to drug interactions;
- (IV) Follow-up management: corollary orders, reminders for drug adverse event monitoring.

The key feature of CDSS is to delivery of the information, what kind of, when and for whom. Osheroff *et al.* summarized this requirement as “five rights”: CDSS should be designed to provide the right information to the right person in the right format through the right channel at the right time. Whatever the CDSS is designed to deliver information, the major role of CDSS is to make sure the patient safety and quality improvement (17).

CDSS can provide tools for efficiency. It can accelerate the clinical process more accurately by supporting the customized order sets for specific diseases, for example, clinical pathways or clinical guidelines. It also contributes to reduce costs and improve patient’s inconvenience by alerting duplicated orders or providing drug formulary guidelines (17,20).

For the consumers of CDSS, who are mostly physicians or nurses, most important things are timing of delivering information, speed and facility for access. To promptly corrections for systemic errors and making suggestion for patient safety and improvement of effectiveness, how much

controls the users over the responses to the CDSS. The appropriate CDSS systems must remind of things the users intend to do. It should provide information the users are unsure what to do. And it can correct errors when the users make. All these support should be supplied timely, promptly and easily (21).

Implementation of CDSS into clinical process effectively with minimally disruptive to clinician's workflow is clearly challenging. Accessing data may interrupt clinician's workflow if the required data are not appropriately integrated into CDSS. Overridden alert or warning messages may induce fatigue so to make clinicians ignore them (22). Successful installation of CDSS needs customization to users' environment. In addition to the effort for improvement and corrections, the interface for users, such as documentation tools or order sets should be designed to let the users can choose or demand the compositions (23).

It is sure that the implementation of CDSS has great impact on the clinical work systems. Several RCTs has demonstrated the effect of CDSS on quality improvement and cost reduction, still there seems to be lack of evidences. The best way to evaluate the impact of CDSS is RCTs. However, conduction of RCTs for evaluation of CDSS is somewhat challenging because it is expensive, usually cannot be initiated without external funding. Another reason is that the outcomes which can be measured as an impact of CDSS are generally hard to detect and access. For example, preventing adverse drug events, one of the main goal of CDSS, is incomparably infrequent, and hard to measure the preventive power (24).

Although many non-RCTs studies have supported the effectiveness of CDSS in improvement of quality, reduction of expenses, and patient safety, there still need more evidences supported by RCTs.

Clinical pathway

Clinical pathway is a structured multidisciplinary care plans for healthcare services which describes detailed essential steps in the care of patients in a particular condition or disease. Usually it aims to incorporate evidences to clinical practice for optimization of clinical outcomes. In narrow sense, it means order sets tailored for particular conditions or types of patients. Other name of clinical pathway is fact-track and enhanced recovery protocol. Historical background and details of clinical pathway was described in the chapter for enhanced recovery.

Clinical indicators

As described above, one of the major advantages of CDSS is to improve quality of healthcare service. Clinical indicators are tools for measurement of quality improvement. They can be defined in several ways. They are measures for assessment of a particular healthcare process or outcomes (25). They are quantitative measures that can be used to monitor and evaluate the quality of important clinical management that affect patient outcomes (26). They are measurement tools, screens, or flags that are used as guides to monitor, evaluate and improve the quality of patient care, clinical support services, and organizational function that affect clinical outcomes.

Ideal clinical indicators should be based on agreed definitions, highly and optimally specific and sensitive, and should be valid and reliable. They also can discriminate well and relates to clearly identifiable events for the users. They should be evidence-based and permit useful comparisons (27).

Clinical indicators can be classified into rate-based or sentinel. Rate-based indicators are for data to be expected to occur with some frequency. They can be expressed as proportions or ratios. Examples are postoperative infection rates or postoperative length of hospital stay. Sentinel indicators mean undesirable events or phenomenon, which usually initiate further investigations, such as postoperative mortality (26).

Indicators can be related with clinical structures, process or outcomes (28). Structures included indicators for equipment, facilities, financing, medical staffs. Process means what is actually doing, that is, diagnosis, treatment, or other interaction with patients. Indicators for outcomes measure the effect of care process on the patients, such as mortality, morbidity, functional status, quality of life or patient satisfaction (29). Potential factors that might affect the outcomes of care are included in risk adjustment indicators. Demographic or lifestyle factors such as gender, smoking, comorbidities are factors adjusted before assessment of outcome indicators (30).

Clinical indicators can be expressed as numbers, rates, or averages. They are devised to support the clinicians, hospital officers, or policy maker to achieve improvement in healthcare service. Qualified clinical indicators are important for the surveillance of healthcare improvement.

Conclusions

For timely and effective delivery of healthcare service,

evidence based multimodality care plan is essential. Without supporting HIT, these enhanced recovery protocols cannot be operated properly. Explosively increasing new evidences for clinicians including diagnosis, treatment and follow-up can be promptly integrated to the clinical practice and applied immediately by this technology. Although continuous evolution of clinical decision making systems and more research evidences are needed for demonstration of effectiveness, HIT is a necessary condition for improvement of quality of patient safety in healthcare service.

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Footnote

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