Registration and analysis of surgical complications: Bearing the burden of broken butterflies

Visser, A.

Citation for published version (APA):
‘White Air’ has a balloon filled up with white air. It helps the little butterfly to rise up. Anne ten Donkelaar.
Chapter 10

Summary and Future Perspectives
CHAPTER 10

SUMMARY AND FUTURE PERSPECTIVES
SUMMARY AND FUTURE PERSPECTIVES

Transparency about complications occurring within a specific hospital and department, and even on a national level, gives insight into the quality of care and potential areas for improvement. The research in this thesis focussed on the quality of the complication registration in hospitalised surgical patients, in particular as to the recording of detailed information about the incidence, number and grade of occurring complications. Additionally, the gaps in the current complication registration and several initiatives for improving the quality of complication data were addressed. Finally, insight in the hospital costs of complications in surgical patients was gained.

This thesis comprises two parts. The first part addressed the quality and quantity of the complication registration; the second part addressed the improvement of the quality of the complication registration.

PART I

In Chapter 2 we analysed the complication rate in an academic hospital over a 6-year period to study the effect of this registry and reporting system on the incidence of complications and possible trends in time. During the period 2004–2009, all adult surgical patients admitted to and discharged from the Department of Surgery were selected for this time trend study. The Dutch national surgical complication registry (LHCR) was used in the analysis, in which complications are registered according to a three-tiered matrix-like classification system. This study showed a significant increase of the complication rate (13% to 18%). The increase was mainly due to a rise in less severe complications, in particular delirium (0.4% to 4.8%) and gastro-intestinal dysfunction (2%-14%). A higher age, male gender, higher American Society of Anaesthesiologists (ASA) class, and surgical complexity were associated with a higher complication rate.

In Chapter 3 we studied the completeness of the national complication registry database (LHCR) as used at the Department of Surgery in our hospital. The department’s complication database currently used, only contains complications that are reported during morning hand-offs and in discharge letters. We compared this registry with relevant information from other available resources in a retrospective reliability analysis.

From the 3252 patients admitted to the surgical wards in 2010, the authors randomly selected a cohort of 180 cases, oversampling those with complications. The authors checked whether the number and severity of complications as recorded in the department’s complication database agreed with those reported in morning hand-offs, discharge letters, and medical and nursing files. Of all patients with complications 86% were recorded in the
Post-discharge complications of patients are not systematically included in the department’s complication database as used in our hospital. These complications are registered only if they result in re-admission or re-intervention in our hospital. In Chapter 4 we investigated which method, a telephone interview or a questionnaire by mail, would be the best method to collect post-discharge complications as reported by the patients. We performed a randomised clinical equivalence trial. From December 2008 until August 2009, all adult surgical patients admitted to a university hospital were randomised to be approached by mail or by phone 30 days after discharge, 890 by means of a telephone interview and 705 through a questionnaire, to collect information about post-discharge complications. In all, 1595 patients were contacted. The response rate was higher in the telephone group than in the questionnaire group (63.8% vs. 51.3%). This trial showed that about 40% of surgical patients reported experiencing one or more complications during the 30-day period after discharge, most of which required additional non-operative or surgical treatment. The two survey methods did not differ significantly in their ability to appreciate post-discharge complications as reported by the patients: 43.3% in the telephone group versus 39.6% in the questionnaire group. Length of stay, ASA class, and type of surgery, but not the survey techniques compared here, significantly influenced the number of complications reported. Complications categorised as a “functional disorder” (e.g., ileus, gastro paresis, weight loss) were reported twice as much in the telephone group. In the questionnaire group, the most frequently (19%) reported complication belonged to the category “other” (e.g., mental disorder).

The decision to use either method may be determined by the institution, costs involved and labour requirement. Certainly, information about complications after discharge is valuable for improving the quality of care and for informing the patient about the benefits and risks of a treatment.
In Chapter 5 patient-reported complications from the previous study (chapter 4) were compared with surgeon-reported complications to determine the frequency, type, and grade of post-discharge complications in a prospective cohort study. These patient-reported complications were compared with the surgeon-reported post-discharge complications and letters from the outpatient clinic as documented in the patients’ medical files.

A total of 976 patients were included. Patients reported more complications (659) than surgeons (465). The most frequently reported complication types were symptoms without specific diagnoses (e.g. pain or fever), infections, and functional disorders (e.g. bowel or cardiac problems, weight loss). Patients reported significantly more complications related to injury by mechanical, physical or chemical cause to the surgical site (RD 2.2%; 95% CI 0.8–3.5), and psychological disturbances (RD 4.3%; 95% CI 2.7–5.8), whereas surgeons did not register any such complications. Surgeons reported significantly more abnormal wound healing than patients (RD 5.9%; 95% CI 2.9–8.9).

Of the patient-reported post-discharge complications 94% were treated non-invasively. Patients sought medical help or advice for 84% (N = 527) of the complications they reported. Of these, more than half (N = 291) were presented to the outpatient clinic (27 of which in another hospital), while 17% (N=92) of the complications were seen in the Emergency Department. For the remaining 27% (N=144) of the complications, GPs were consulted. The complications presented to GPs concerned pain (N = 39), infection (N = 32), and wound problems (N = 11). These complications were all treated non-surgically.

One in four post-discharge complications in surgical patients were missed by the attending surgeon. Most of these patients with complications were diagnosed and treated by the GPs. Surgeons should anticipate to common post-discharge complications and communicate with their patients about what to do, should this happen, to avoid unnecessary involvement of, or referral to, other healthcare professionals.

PART II

The trend to develop national benchmarking data, including those regarding complications in hospitalised surgical patients, is growing. To obtain high-quality benchmarking data a reliable and uniform registration by the participating surgical departments is required. In Chapter 6 the amount of agreement and potential differences in the application and interpretation of the definition of a complication was investigated among the surgical departments of 7 Dutch hospitals. Twenty-four clinical cases were formulated including general, trauma, gastrointestinal and vascular surgery. These were based on points of discussion about the definition and ambiguities regarding complication registration as encountered in daily practice at the Academic Medical Centre in Amsterdam (AMC). The clinical cases were presented to the surgical staff and residents in seven Dutch hospitals using an electronic response system.
A total of 134 participants responded. More than 50% of participants were practising at a university medical centre, almost 40% in a tertiary referral hospital and around 10% in a general training hospital. The main interpretation differences were found regarding:

1) Complications considered to be directly related to the surgical procedure, such as gastro paresis after a gastrectomy or ongoing bowel paralysis following adhesiolyis.

2) Complications occurring after treatment by other specialities such as interventional radiology procedures.

3) Severity grading; criteria regarding when to consider a complication as a ‘(probably) permanent damage or function loss’.

4) Registering a cancelled operation as a complication.

5) Patients with serial complications during hospital stay. For example intra-abdominal abscess and wound infection; registered as one or 2 complications.

Given the considerable differences in interpretation of the current definition of a complication, it is unlikely that uniform registration of complications is currently performed. This uniformity may be enhanced by additions to the current definition, by more agreement about specific clinical situations, and by training of surgeons, thereby improving comparisons at both local and national levels. This seems a prerequisite before such data can be used at the public domain and function as one of the parameters for the quality of healthcare.

In Chapter 7 a systematic review was performed to summarise known factors that can detect surgical complications. We searched all publications addressing predictive factors for the development of surgical complications in adult patients admitted to the gastrointestinal, vascular or general surgery departments. A final set of 30 articles yielded a total of 53 predictive factors studied in various settings, surgical specialties, and disorders. To focus the analysis the 25 most robust and clinically applicable factors (defined as appearing in at least 3 studies) were selected. These factors were then categorised into 4 different groups: Patient-related factors, Co-morbidities, Laboratory values, and Surgery-related factors. The most predictive factors for morbidity in these groups were BMI (with odds ratios (ORs) ranging from 1.80-6.30), higher age (ORs 1.02-4.62), ASA classification (ORs 1.77-7.10), dyspnoea (ORs 1.23-1.30), serum creatinine level (ORs 1.39-2.14), emergency surgery (ORs 1.50-2.54) and functional status (ORs 1.36-4.07). Thus, an overview of several predictors for surgical complications was found that are likely candidates to be used in a trigger tool to help identify patients at risk for a complication.

In Chapter 8 these predictive factors were used to develop a trigger tool that might be useful to improve complication detection. Simultaneously, a diagnostic study was performed to compare the sensitivity, specificity, and time consumption of the new trigger tool with the
standardised clinical registration method. A set of 31 potential triggers was chosen based on the systematic review (chapter 7) and availability of those triggers in hospital databases. A reference standard consisted of 300 patients, 150 with and 150 without complications. The developed trigger tool consisted of 9 triggers, containing: emergency procedure, complexity of surgical procedure above severity class 6, Do Not Resuscitate (DNR) policy, ICU-stay, length of hospital stay of more than 14 days, reoperation, oesophagectomy, pancreatoduodenectomy, acute (or ruptured) abdominal aortic aneurysm surgical procedure. Sensitivities of the trigger tool and standardized clinical registry were 70.7% vs. 78.7%, respectively, while specificities were 70% vs. 100.0%, respectively. Sensitivity values to detect major complications were 97.2% vs. 80.6%, respectively. Time spent by the attendants during morning hand-offs using the standardised clinical registration was 296 hours per year and 133 hours for the database manager. Using the trigger tool, only the database manager would spend 310 hours. Thus, this trigger tool appeared effective to detect patients at risk of complications, particularly the more severe complications, and might save costs.

To estimate the impact of complications in terms of the costs involved, Chapter 9 contains a retrospective cohort study, conducted in 100 consecutive patients who underwent a (pylorus-preserving) pancreatoduodenectomy (PP)PD between January 2012 and July 2013. For each patient, complications occurring during admission or in the 30-day period after discharge were documented. Hospital costs related to the (PP)PD were defined as all costs of medical interventions and resources during the hospitalisation period as recorded by the electronic supply tracking system.

Median hospital costs ranged from €17,482 for a patient without complications to €55,623 for a patient with postoperative haemorrhage. After adjusting for patient characteristics, postoperative haemorrhage was associated with an increase of 39.6% in total hospital costs mainly due to increased hospital stay. Other factors significantly associated with an increase in total hospital costs were: the presence of a malignancy other than pancreatic adenocarcinoma (29.4% cost increase), the severity grade of a complication (34.3% - 70.6% increase) and the presence of a postoperative infection (32.4% increase). Complications can lead to substantial extra costs for the hospital, particularly for diseases commonly treated in tertiary care institutions. With this knowledge we can and will advocate further efforts to reduce hospital costs by shortening the length of hospital stay.
CHAPTER 10

SUMMARY AND FUTURE PERSPECTIVES

FUTURE PERSPECTIVES

Quality control and transparency of outcomes of (surgical) care have become and will remain a priority for hospitals. Recording of complication rates is one of the parameters of quality control. The validity of registration and prevention of complications is an ongoing challenge. One in every 150 patients admitted to a hospital dies as a consequence of a complication, while almost two thirds of in-hospital events are associated with surgical care. The burden for patients and surgeons may be unbearable. Hence, the need for improvement is clear. For the last 15 years substantial investments have been made to improve patient safety. Although improving is a relative slow process, some milestones have been reached. For example, the implementation of the SURPASS checklist in The Netherlands led to a reduction in surgical complications and mortality in hospitals with a high standard of care.

Improving Registration

Successful improvement depends on the validity of complication registry. To obtain high-quality data, reliable and uniform registration by the participating surgical departments is required. Also, interpretation differences regarding specific clinical situations should be reconciled and regulated by the professional society, and by training of (future) surgeons, thereby improving the dataset for comparisons at both local and national levels.

Major complications are rarely missed in the registrations. In contrast, the minor complications that occur during hospitalisation or after discharge tend to be overlooked. This implies that a possible rising trend in minor complications will be missed, which would preclude improvement initiatives that could easily lead to a shorter hospital stay and a reduction of costs and patient burden. For the purpose of obtaining and utilising valid and complete data, hospitals ought to register any complications.

Effort should be made to implement systematic electronic storage and automated triggers in modern hospital data systems. Automated triggering would help surgeons as it reduces their time spent in complication registration, but supposes a greater role for hospital data managers.

Improving Quality of care

Surgeons are obliged to compare the possible unintended harm versus the intended positive results of their interventions and to communicate these findings with their patients before a treatment choice is made.
**Shared Decision-making**

One of the promising possibilities to achieve better healthcare quality is to enhance the role of patients in decision-making and management as to their health and care, based on individual benefits and risks. The growing ICT-opportunities and internet facilities allow for a better integration of patient data and preferences, medical guidelines and evidence on the effectiveness of treatment options, prediction models of health prognosis and risks (complications) of interventions, and decision support systems. Effort should be made to engage (surgical) patients for whom several treatment options are available in their healthcare process and selection for treatment to improve the quality of their care and life. This could be achieved by offering the patients and their clinicians an interactive patient-specific support and decision-making system in the hospital setting. Here also, valid data from complication registries is mandatory for these prediction models and risks of interventions in decision-making systems.

**Cost Effectiveness**

Total hospital costs after surgery increase substantially if a complication occurs. The increase in hospital costs due to complications can mainly be ascribed to a prolonged hospital stay. Length of hospital stay can be influenced by implementing specific protocols or programmes to reduce hospital stay (e.g., fast-track surgery) or through cooperation with other hospitals and skilled nursing facilities. The use of patient-related or surgery-related triggers as so-called ‘red flags’, highlighting the patients who are at risk of developing complications, could also be useful in the improvement of complication prevention. Prior to admission and surgery some factors modifying the outcome could be addressed, like a preoperative nutritional intervention, preoperative alcohol and smoking cessation, which may diminish the risk of developing complications. Prevention and early diagnosis of complications by the implementation of several evidence-based bundles could contribute to reduction.

**Prevention of Complications**

Complications should preferably be avoided, but some complications may be accepted as a ‘calculated risk’ if it is outweighed by the anticipated positive effect(s) of the intervention. Actions should be taken for implementing methods like the SAVE-method; a multidisciplinary, proactive and structured complication meeting, to detect potentially preventable complications. The main purpose of these methods, based on chart reviews, is not to count preventable harm, but to gain an insight into the bottleneck of the healthcare process, and to eventually improve the quality of care. The bottlenecks can occur in processes at department level as well as processes at hospital level.
The Need for Complication Registration in the Future

Although academic hospitals seem more subspecialty-driven, this represents only a small part of all surgical care. Most subspecialities have their specific registration system such as the national audits for colorectal, pancreatic, and oesophageal surgery.\textsuperscript{11} A generic registration still is of importance for general departments of surgery in smaller hospitals but equally for the academic hospitals. Moreover, complication registration is an outcome-driven registration. It enables us to review trends in complications, such as an increasing postoperative infection rate. These trends should be reviewed and analysed on the higher level of general surgery because the processes or actions for improvement may transcend the subspecialty.

A further development could be a shift in perspective from a specialty-driven to a patient-driven registration. Working in multidisciplinary teams has become increasingly more important in healthcare; GI-surgeons form teams with endoscopists, vascular surgeons with interventional radiologists. Some years ago, the report entitled “To err is human” also argued in favour of teamwork, a concept that might be able to prevent a large number of avoidable complications.\textsuperscript{10} This pleads for a more consistent registration of all complications, meaning that all complications of a patient developed during the hospital stay at any location should be registered, regardless of which specialty identified the complication. The data can subsequently be used for improvement actions. Thus, registration of complications may evolve from a necessary burden to an essential tool for improving quality of surgical care.

Furthermore, patient-specific information may be used in decision-making within a specific hospital, department or individual patient. The responsibility for the treatment choice and its potential risk for complications should be in the hands of both surgeon and patient. Promising future possibilities will lead to a joint responsibility of multidisciplinary teams and the very patient, ensuring high quality of care.
REFERENCES


‘White Air’ has a balloon filled up with white air. It helps the little butterfly to rice up. *Anne ten Donkelaar.*