

Outcomes in day surgery

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Purpose of review

To summarize and examine the updated published results on the outcome measures that can be used to assess the quality of ambulatory surgery and anesthesia.

Recent findings

Major morbidity and mortality following ambulatory surgery is exceedingly low. Cancellations and delays may have a negative impact on the patients, healthcare personnel and the organizations. Minor cardiovascular adverse events are the most common intraoperatively and are associated with preexisting cardiovascular diseases and elderly patients. Respiratory events postoperatively are associated with obesity, smoking and asthma. Also, pain is a common cause for longer postoperative stay, unanticipated admission and readmission. Postoperative nausea and vomiting occurs in 30% of patients and strongly affects patient satisfaction. Furthermore, prolonged stays are mainly caused by surgical factors, or minor symptoms like pain or nausea. Surgical factors are also the main causes of unanticipated hospital admission. The type of surgery and the 24 h postoperative symptoms may affect the degree of return to daily living function. Also, patient satisfaction affects the outcome of healthcare and the use of healthcare services.

Summary

Ambulatory surgery, as currently practiced, provides quality care that is cost-effective. Minor adverse events such as pain and postoperative nausea and vomiting are still common, and improvement could be targeted in these areas.

Keywords

adverse outcomes, ambulatory anesthesia, ambulatory surgery, nausea and vomiting, pain, quality improvement, readmissions

Introduction

One of the most significant changes in surgical practice over the past two decades has been the change in emphasis from inpatient to ambulatory surgical care. Advances in surgical and anesthetic techniques were a prerequisite for this tremendous growth in ambulatory surgery worldwide. The continued improvement in anesthesia techniques, such as regional anesthesia, ultra-short acting drugs with minimal side effects, more relevant ambulatory discharge criteria, and minimal invasive surgery techniques will allow larger numbers of patients to take advantage of ambulatory surgery [1,2].

Ambulatory surgery allows earlier return to preoperative physiological state, fewer complications, reduced mental and physical disability, and early resumption of normal activities. Hospital costs are lower because ambulatory surgery is more efficient than inpatient care.

The rapid growth in ambulatory surgery has resulted in the need for healthcare personnel and organizations to find an objective way to measure the quality of care provided. The assessment should include monitoring the clinical process of care and measurement of patient-assessed outcomes. These outcomes may be used to set standards of practice.

Quality

Quality management is essential to the practice of anesthesia. Industrial quality measurement such as quality control, quality management, and continuous quality improvement have been introduced into the healthcare and anesthesia area [3]. The *Concise Oxford Dictionary* defines quality as 'possessing a high degree of excellence'. Donabedian [4] defines the quality of medicine as 'that kind of care which is expected to maximize an inclusive measure of patient welfare, after one has taken account of the balance of expected gains and losses that attend the process of care in all parts'.

Quality may be defined in a different way by each observer: the healthcare system, anesthesiologists, surgeons and patients, and according to Duncan [5], it should satisfy all of them. In hospitals, quality has been defined by seven attributes requiring assessment by all departments including anesthesia. These attributes are safety, provider competence, acceptability, accessibility, efficiency, appropriateness, and effectiveness [6]. For the surgeon, the measure of quality in anesthesia is often reflected in the factors that contribute to the facilitation

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Abbreviations

ASA American Society of Anesthesiologists
ENT ear–nose–throat
PONV postoperative nausea and vomiting

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of the surgical procedure. For the patient, quality is reflected in patient satisfaction. During the past 25 years, the predominance of the physician's view of quality has given way to appreciation of the patient's or the customer's point of view. It mirrors the increasing interest in patient-oriented outcomes over the past few decades [7]. Finally, the increased focus on patient-oriented outcomes comes at a time when advances in anesthesia care have significantly decreased the incidence of mortality and major morbidity. Lately, benchmarking of quality performance indicators is beginning to be the norm for ambulatory surgical centers.

Why morbidity and mortality are not good indicators to measure outcomes in ambulatory surgery

The traditional measures of quality and safety for surgery and anesthesia are by rates of perioperative mortality and morbidity. They are also applicable to ambulatory surgery and anesthesia. They are only rough measures, however, and do not necessarily reflect the quality of care, but rather the overall health status of the patient population undergoing ambulatory surgery, which could differ from one surgical center to another.

Ambulatory surgery is being mandated for sicker patients who often present with one or more chronic illness and who may be predisposed to increases in perioperative morbidity. The American Society of Anesthesiologists (ASA) physical status classifications have been shown to be a predictor of postoperative outcome. The risk of complications may be greater in ASA class III and IV patients [8]. In addition, the number of elderly patients undergoing ambulatory surgery is rapidly expanding. Elderly patients may have a twofold increased risk of cardiovascular events [9–11]. In a study of 564 267 outpatient surgical procedures, Fleisher *et al.* [11] identified that age over 85 years, previous inpatient hospital admission within 6 months, surgical performance at a physician's office or outpatient hospital, and invasiveness of surgery identified those elderly patients who were at increased risk of inpatient hospital admission or death within 7 days of surgery.

Deaths related to ambulatory surgery or anesthesia are extremely rare, and low rates of major morbidity are reported throughout the relevant literature. Warner *et al.* [12] followed 38 598 ambulatory surgical procedures for 30 days after surgery. They documented only four deaths, two of which were caused by myocardial infarction, and two were the result of automobile accidents. In the same study, 31 patients (0.08%) had major morbidity including myocardial infarction, central nervous system deficit, pulmonary embolism, and respiratory failure. In their recent work, Jenkins and Barker [13] demonstrated similar low mortality rate, 0.5 per 10 000 anesthetics.

In a recent review of surgical procedures performed in physician offices and ambulatory surgery centers in Florida during a 2-year period, Vila *et al.* [14] found that the death rate per 100 000 procedures performed was 9.2 in physician offices and 0.78 in ambulatory surgery centers. The relative risk for injuries and death for office procedures versus ambulatory surgery centers was 12.4 and 11.8 times more, respectively [14]. Moreover, adverse incidents in ambulatory centers also occurred at a low rate: 5.3 per 100 000 procedures compared with 66 per 100 000 procedures in physician offices [14]. The rarity of these events among ambulatory surgical patients further limits the use of these outcomes in quality assessment. There are also many other factors contributing to mortality, for example preexisting medical conditions, surgical factors, training of providers, hospital factors, and home environment. The anesthetic component may be the least likely to be the precipitating factor unless the mortality occurred almost immediately in the perioperative period.

Intermediate outcomes that include events such as hypoxemia, ischemia, and postoperative hypertension may be more useful endpoints. Their use is very limited, however, even though they occur with greater frequency than major morbidity or mortality. Their definitions are generally agreed upon, and they can be more readily attributable to the physician's actions [15]. Orkin *et al.* [16] emphasized the still unproven relationships between most intermediate events (for example, transient intra and postoperative hypoxemia) and clinically significant adverse events (death, myocardial infarction, etc.) as well as the difficulties in establishing those relationships.

The morbidity rates varied between 4% and 5% in the intraoperative period and between 7% and 10% in the immediate postoperative period at ambulatory surgical units [9,17–19]. These studies also include minor non-life-threatening adverse events, such as blood pressure irregularities, postoperative pain, and nausea and vomiting, which allows better differentiation of the quality of care at the different ambulatory surgical centers. It also reflects the burden of ambulatory surgery on healthcare providers and on patients because minor events may require patient care and prevent patients from returning to their preoperative functional level.

The indicators to measure outcomes

To set standards of quality in anesthesia care, it is necessary to measure outcomes, as summarized in Table 1. The ASA Committee on Ambulatory Surgical Care and the Task Force on Office Based Anesthesia have also developed a list of outcome indicators for office-based and ambulatory surgery (Table 2) [20].

Table 1 Outcome measures in ambulatory surgical unit

Cancellations and delays
Adverse events
Cardiovascular (blood pressure abnormalities and arrhythmia)
Respiratory (reintubation, aspiration pneumonitis, pulmonary embolus)
Central or peripheral nervous system new deficit
Anaphylaxis
Possible malignant hyperthermia
Infection
Local anesthetic toxicity
Prolonged postoperative stay
Unanticipated hospital admission
Return hospital visit and readmission
Return to operating room
Unplanned postprocedural treatment in physician's office or emergency department
Unplanned admission to hospital or acute care facility
Cardiopulmonary arrest or death
Postoperative patient function
Patient satisfaction

Cancellations and delay

Cancellations and delays undoubtedly affect the quality of the provided care. They have negative impact on patients, healthcare personnel and organizations as parties of the

Table 2 Outcome indicators for office-based and ambulatory surgery

ASA Committee on Ambulatory Surgical Care and Task Force on Office Based Anesthesia
Outcome events
Follow-up on postop day 1 and day 14; also day 30
Cancellation rates and reasons
Central or peripheral nervous system new deficit
Need for reversal agents: narcotic, benzodiazepine
Reintubation
Unplanned transfusion
Aspiration pneumonitis
Pulmonary embolus
Local anesthetic toxicity
Anaphylaxis
Possible malignant hyperthermia
Infection
Return to operating room
Unplanned postprocedural treatment in physician's office or emergency department
Unplanned admission to hospital or acute care facility
Cardiopulmonary arrest or death
Continuous quality indicators
Ongoing
Cardiovascular complications in recovery requiring treatment (including arrhythmias; hypotension, hypertension)
Respiratory complications in recovery requiring treatment (including asthma)
Nausea not controlled within 2 h in recovery
Pain not controlled within 2 h in recovery
Postoperative vomiting rate
Prolonged PACU stay (>2 h)
Medication error
Injuries, e.g. eye, teeth
Time to return to light activities of daily living
Common postoperative sequelae, e.g. sore throat, muscle pain, headache
Postdural puncture headache or transient radicular irritation
Discharge without escort or against medical advice
Patient satisfaction
Equipment maintenance

Source: <http://www.asahq.org/publicationsAndServices/outcomeindicators.pdf>. PACU, postanesthesia care unit.

process. Fried and Twersky [21] pointed out the importance of the preoperative process as a prime example for outcome measurements. Changes in a patient's medical status from the time of presurgical testing to the day of surgery could be one of the reasons for the cancellations. Other reasons include incomplete medical workup, patient refusal, no show for surgery, and noncompliance with the preoperative orders, such as the patient's fasting status. It is also important to differentiate provider-related from patient-related problems.

One of the main functions of the anesthesia preoperative evaluation clinic is to ensure that the patient is able to proceed with the planned procedure on the day of surgery. This emphasizes the role of the anesthesiologist in decreasing cancellations and delays [22]. Also the anesthesia preoperative evaluation clinic can improve quality and value for patients. For example, eliminating unnecessary laboratory tests and medical consultations can produce significant cost saving [23].

Adverse events

Adverse anesthetic outcome is the occurrence of unanticipated complications or death during the perioperative period that could be attributable to an anesthetic [24]. Factors such as intraoperative cardiovascular events, respiratory events, postoperative pain, postoperative nausea and vomiting (PONV), prolonged postoperative stay, unanticipated hospital admission, readmission, postoperative functional level, and patient satisfaction are considered to be intermediate outcomes, and occur with higher incidence. Today this is the major area of quality assessment and an area in which improvement could be targeted [3].

Cardiovascular adverse events

Cardiovascular adverse events remain the most common intraoperative adverse events, occurring during ambulatory surgery [9,10,17,25,26] at an incidence of approximately 2%. Blood pressure abnormalities and rhythm disorders are the most frequent events, occurring mostly in patients with preexisting cardiovascular diseases and the elderly [10,26].

Perioperative cardiovascular adverse events may result in a prolonged postoperative stay. Cardiovascular events warranting unanticipated hospital admissions as well as life-threatening cardiovascular events, for example myocardial infarction, are extremely rare among ambulatory surgical patients. Warner *et al.* [12] found that the incidence of severe cardiovascular complications is lower than the rate expected in the general population.

Respiratory adverse events

Respiratory adverse events are the second most frequent adverse events, occurring with a frequency of 0.1%. The

most common respiratory adverse events are laryngospasm and bronchospasm with or without oxygen desaturation, but other adverse events such as apnea, aspiration, pneumothorax and pulmonary edema are also reported [9,10,26]. Intubation-related events during general anesthesia, such as difficult intubation, esophageal intubation, or dental damage also occur with a low incidence (0.2–0.5%) [9,19]. Although infrequent, respiratory adverse events may result in unanticipated patient admission [27,28]. Patient characteristics are strongly associated with respiratory adverse events. Smokers, obese patients, and patients with asthma are at two to fivefold higher risk of developing perioperative respiratory events in ambulatory surgical centers [26,29].

Postoperative pain

Postoperative pain is one of the most frequent adverse events occurring after ambulatory surgery. It is associated with a longer postoperative stay and delay in returning to normal daily living function. Postoperative pain is also one of the common causes for unanticipated admission and readmission [30]. The type of surgical procedure influences the incidence of postoperative pain. The majority of patients (40–70%) reporting a high incidence of postoperative pain had undergone orthopedic, general, or plastic surgical procedures [2,31]. The duration of surgical procedure is also known to be one of the predictors of postoperative pain. After 90 min procedures, 10% of patients suffered from severe pain. After 120 min procedures, the number of patients with severe pain was doubled [2].

Multimodal pain management is a cornerstone of the quality improvement and efficiency of ambulatory anesthesia. Proper postoperative pain management should be started in the preoperative period [2,32,33]. Multimodal analgesia with drugs that work at different sites of the pain pathway has been gaining more attention in the literature [32,33,34,35]. Opioids work on opioid receptors in the central nervous system, local anesthetics work on peripheral and regional nerves, while nonsteroid analgesics work on the peripheral cyclooxygenase pathway. Together, these drugs provide pain relief synergistically, which is superior to what each drug would render individually. Side effects such as PONV are reduced because lower doses of each drug are administered [36]. A combination of nerve blocks, systemic opioids and nonsteroidal antiinflammatory drugs are recommended whenever possible [36,37].

Postoperative nausea and vomiting

PONV remains a frequent complication of ambulatory anesthesia [9]. Although the true medical impact of PONV is relatively minor, according to the latest published data, it occurs in 30% of patients, and is undoubtedly distressing for the patient [38]. Approximately 36% of patients who

experience postdischarge nausea and vomiting do not experience any nausea or vomiting before discharge from hospital [39]. PONV strongly affects patient satisfaction.

There are three main groups of risk factors for high PONV incidence: patient, surgical, and anesthesia. The use of volatile agents, nitrous oxide and opioids, and high-dose neostigmine is related to anesthesia factors. Female sex, history of PONV, motion sickness, being a nonsmoker, and need for postoperative opioids are five main risk factors [40]. Furthermore, the presence of two or more factors significantly increases the risk of PONV. Sinclair *et al.* [41] have found that incidence of PONV is influenced by the type of ambulatory surgery. Patients undergoing such procedures as laparoscopic, intraabdominal, ear–nose–throat (ENT), dental, orthopedic, and plastic surgery have a higher risk [41].

In a study of 16 411 ambulatory surgical patients, Chung and Mezei [19] demonstrated that PONV is among the most important factors contributing to a prolonged postoperative stay following ambulatory surgery. The causes of PONV are multifactorial; a multimodal approach should be used once a high-risk patient is identified [38,42–44]. Anesthesia-related PONV risk factor management includes regional anesthesia, providing adequate hydration, and avoiding general anesthesia if possible [44]. When general anesthesia is essential, a low emetogenic anesthetic should be used. Gan *et al.* [44] have described the strategy and precise algorithm for PONV management. These recommendations could be widely used in ambulatory anesthesia for PONV reduction. Some controversy still remains regarding PONV prophylaxis with antiemetics. Routine antiemetics prophylaxis of all patients is not recommended, but patients at high risk can benefit from prophylaxis. Patients at moderate risk usually require single or combined agent antiemetics prophylaxis for PONV treatment. Double and triple antiemetics combinations should be used for patients at high risk of PONV.

Prolonged postoperative stay

Duration of postoperative stay or time of discharge is an outcome measure of ambulatory surgery and anesthesia (Table 3). Factors that affect discharge time in patients undergoing ambulatory surgery have been studied (Table 3) [19,45]. The conclusions drawn were that efforts to shorten discharge time would be best directed at improving nursing efficiency, ensuring availability of an escort for the patient, and preventing postoperative pain, drowsiness, and emetic symptoms.

In another large epidemiological study, Chung and Mezei [19] found that increasing age, otorhinolaryngology, strabismus surgery, and congestive heart failure were the important preoperative predictors of delayed discharge.

Table 3 Factors delaying discharge from ambulatory surgical unit

Preoperative:	Female gender Increasing age CHF
Intraoperative:	Long duration of surgery General anaesthesia Spinal anaesthesia
Postoperative	PONV Pain Drowsiness No escort

CHF, congestive heart failure; PONV, postoperative nausea and vomiting.

Intraoperative factors such as general anaesthesia, long duration of surgery, and the presence of intraoperative cardiac events all contribute to a delay in discharge. Postoperative pain, nausea and vomiting are the two factors that commonly prolong stay after ambulatory surgery [46–48].

Duration of postoperative stay correlates with the frequency of minor or moderately severe complications [19,45]. Although these complications do not usually require hospital admission, they can delay discharge of patients.

To accelerate safe discharge, it is imperative to establish appropriate discharge criteria. The postanesthetic discharge scoring system for home readiness after ambulatory surgery is simple, practical, and safe, and can be used to replace the clinical discharge criteria [49]. In summary, it is very hard to eliminate the factors that lead to delayed discharge; however, knowledge of these factors by the anesthesiologist, surgeons and nurses together with modification of perioperative management will make its occurrence a rarity.

Unanticipated hospital admission

Unanticipated hospital admission is an easily identifiable and significant outcome measure in the ambulatory surgical setting (Table 4). The incidence of unanticipated hospital admission reflects the occurrence of perioperative complications while in the ambulatory facility that require admission to hospital. Hospital admission not only adds to the cost of healthcare, but it is also disruptive for patients and families [50]. The rate of unexpected admissions varies between 0.28 and 9.5% depending on the definitions and reporting mechanisms of the different studies [27,28,51,52].

The causes of unanticipated hospital admissions can be divided into four categories: surgical, anaesthesia, medical, and social (Table 4) [27]. The most frequent reasons are surgical complications, such as bleeding, misadventure, excessive pain and more extensive pain. Anaesthetic-related complications include PONV, somnolence and

Table 4 Risk factors for unanticipated hospital admission

Surgical
Pain
Bleeding
Extensive surgery
Surgical complications
Abdominal surgery
ENT and urological surgery
Anaesthesia
Nausea and vomiting
Somnolence
Aspiration
Social
Discharge without escort
Medical
Medical complications related to DM, IHD, and sleep apnea
Medication error

ENT, ear–nose–throat; DM, diabetes mellitus; IHD, ischemic heart disease.

dizziness. The third group is due to worsening of pre-existing medical factors, such as diabetes, angina, sleep apnea, or as a result of intraoperative or postoperative complications, such as dysrhythmias, myocardial infarction, bronchospasm [27]. Five to 20% of unanticipated hospital admissions occur for social reasons, such as no available escort or inadequate home support. Further efforts toward their reduction are warranted.

Return to hospital and readmission

A return hospital visit is defined as a visit to the emergency room or ambulatory surgical unit (ASU) or hospital within 30 days of surgery. In association with ambulatory surgery, hospital readmission is defined as an ambulatory surgical patient requiring inpatient admission following discharge from an ASU due to complications [53,54]. The readmission rate after ambulatory surgery is between 1 and 3% [53–55].

The result of a 3-year analysis shows that 1.1% of 17638 patients were readmitted within 30 days of ambulatory surgery, and only 0.15% of patients were readmitted as a result of complications. Furthermore, no anaesthesia-related readmissions were reported [54].

Coley *et al.* [51] retrospectively evaluated the return to hospital and readmission rate in 20817 patients following ambulatory surgery. The percentage of return visits to the hospital within 30 days was 5.7%. Of these return visits, 1.5% were directly related to the original ambulatory surgery procedure. Pain was the most commonly reported reason for return, occurring in 38% of patients. General surgery, ENT and urology were the specialties that had the highest rate of readmissions accounting for 3.2%, 3.1% and 2.9%, respectively.

Return hospital admission is an outcome related mainly to surgical complications such as extensive surgery, pain and urinary retention. A regular quality assurance audit at a local level to identify factors leading to hospital

readmission is mandatory, together with the proper selection of patients, especially in ENT and urology patients.

Postoperative functional level

Complete and quick return to daily living function of the patient to the preoperative level reflects the ultimate success of ambulatory surgery. The type of surgery and the 24 h postoperative symptoms, such as incision pain, PONV, drowsiness, dizziness, headache or fever, affect the degree of return to daily living function [31,56].

Symptoms of distress and reduced functional status were shown to be common 7 days postoperatively, and only 22% of patients returned to full or part-time work by the seventh day after surgery [56]. The major findings from this study suggest that, although the provider's cost may have been reduced with transition to ambulatory surgery, a significant portion of cost or impact of this care may be merely shifted to the patient and family [56]. The questionnaire used by Myles *et al.* [57] has been well developed and has good validity and reliability. Further efforts should be made to achieve complete and quick return of patients to their preoperative level in order not to shift the cost or impact of the patient care from the hospital to the patient or his family.

Patient satisfaction

Patient satisfaction is one of the client-assessed outcomes and a very important component of improving the quality of healthcare. Patient satisfaction affects the outcome of healthcare and the use of healthcare services [58]. Therefore, it is important to identify the reasons and the risk factors for patient dissatisfaction. An appropriate measure of patient satisfaction could be a potentially useful indicator of the quality of anesthesia care, providing unique feedback [59].

Patient satisfaction has been defined by subjective and objective measures [60]. The subjective measures are the provider's success at meeting client values and expectations [61].

Patient satisfaction can be defined as 'a healthcare recipient's reaction to their care, a reaction that is composed of both cognitive evaluation and an emotional response'. The theory behind the process of arriving at a satisfaction level can be divided into three stages [59]. First, the patient must have a standard or expectation level regarding their potential care. The standard may vary depending upon patient background, education, past experience and their ideals. Second, the patient receives a level of care. Lastly, a judgment is made to determine the difference between the expected and actual care. Therefore, the level of care provided is only one factor determining a particular satisfaction level. Also, we do not know how a

patient determines their expectation level or judges the discrepancy between the expected and the actual care.

To assess patient satisfaction properly is very difficult, since satisfaction is a multidimensional concept with determinants that are not yet clearly defined [62]. Recently a lot of sophisticated questionnaires have been specifically designed to evaluate primary ambulatory care, for example, the Patient Satisfaction Questionnaire (PSQ) and the Patient Judgment of Hospital Quality Questionnaire (PJHQ) [63]. The PSQ contains eight dimensions that reflect components of ambulatory care (technical, interpersonal care, availability and continuity of care, etc). The PJHQ is divided into the hospital services or phases of hospital care, such as medical, nursing, admissions, and discharge.

Many surveys utilizing single-item scales demonstrate high levels of satisfaction, but do not show that changes in care alter level of patient satisfaction [64]. This reinforces the need for questionnaires with multi-item scales that are broad and encompass many aspects of care. For a number of reasons, the nature of anesthesia supports the use of psychometric questionnaires to assess patient satisfaction. First, many patients are naïve about the role of an anesthesiologist and their qualifications. Second, many surveys to date are biased towards the anesthesiologists who constructed them. Finally, with poorly constructed surveys, the effect of anesthetic care may be indistinguishable from perioperative care in general. Psychometric tests of good construction include the Iowa Satisfaction with Anesthesia Scale [65] for monitored anesthesia care, and Whitty *et al.*'s scale [66] for patients undergoing ophthalmologic and maxillofacial surgery under general anesthesia. Quality of recovery score is a reliable and validated tool developed to assess quality of recovery with a significant relationship to satisfaction with anesthesia care [67].

Conclusion

Ambulatory surgery, as currently practiced, has an excellent safety record and provides quality care that is cost-effective. The use of innovative surgical and anesthetic techniques will allow larger numbers of patients to take advantage of the benefits of undergoing elective operations on an ambulatory basis. Minor adverse events, such as pain and PONV, are still common. The occurrence of these minor adverse events is now the major area of quality assessment and an area in which improvement could be targeted [3].

Total quality management programs are important in the ambulatory surgery program to help provide the best quality at a competitive price. To achieve this goal, we must define quality management and improve quality-related issues to meet the challenge of ambulatory

anaesthesia and surgery that will continue to grow and expand in the future.

References and recommended reading

Papers of particular interest, published within the annual period of review, have been highlighted as:

- of special interest
- of outstanding interest

Additional references related to this topic can also be found in the Current World Literature section in this issue (pp. 661–662).

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