A Systematic Review of Postoperative Recovery Outcomes Measurements After Ambulatory Surgery

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BACKGROUND: Mortality and morbidity in ambulatory surgery are rare, and thus the patient's quality of life (i.e., the ability to resume normal activities after discharge home) should be considered one of the principle end-points after ambulatory surgery and anesthesia. We conducted a systematic review of the instruments to measure the quality of recovery of ambulatory surgical patients in order to advise on the selection of appropriate measures for research and quality assurance.
METHODS: A systematic literature search of MEDLINE, EMBASE, CINAHL, HAPI, PsycINFO, Web of Science Search History, Biosys Previews Search, HealthStar, and ASSIA was performed to identify patient-based outcome measures to assess postoperative recovery from ambulatory anesthesia. The instruments were assessed for eight criteria: appropriateness, reliability, validity, responsiveness, precision, interpretability, acceptability, and feasibility.
RESULTS: Seven articles met the inclusion criteria set for the review. The quality of the identified instruments was variable.
CONCLUSION: Only one instrument, 40-item Quality of recovery score, fulfilled all eight criteria, however this instrument was not specifically designed for ambulatory surgery and anesthesia.
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Postoperative recovery is a complex process related to various outcomes, such as physiological end-points, incidence of adverse events, and change in psychological status (1). Previous studies of recovery after surgery and anesthesia have focused primarily on the physiological end-points, and the incidence of adverse events, including major morbidity and mortality. However, because of the advances in both surgical and anesthetic techniques, particularly in ambulatory surgery, mortality and major morbidity have become rare events. Thus, measurement of patient health status, or quality of life has become an important end-point in many clinical studies (2–4). The patient's ability to resume normal activities postoperatively is an important indicator of successful ambulatory surgery and anesthesia. Thus, it is important to evaluate the quality of recovery after surgery and anesthesia from the patient's perspective, and to adequately identify patient-based outcomes important to the overall recovery process using a standardized and valid instrument (5).

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There has been considerable growth in the production of patient-based outcome measures (6,7). A review of quality of life measurements revealed that in some specialties there are numerous measures of quality of life and little standardization (6). Much of this work has occurred in specialties dealing with chronic disease states such as cancer, rheumatology, and musculoskeletal disorders (6). Established generic measures such as the SF-36 and Sickness Impact Profile have not been tested on the ambulatory surgical population for postoperative recovery.

It is the aim of the present review to identify instruments to measure postoperative recovery outcomes within 1 wk after ambulatory surgery, a period when most patients have functionally recovered (1), and assess each instrument for eight criteria: appropriateness, reliability, validity, responsiveness, precision, interpretability, acceptability, and feasibility in order to advise on the selection of appropriate measures for research and quality assurance. These criteria have been proposed as necessary when selecting a patient-based outcome measure to include in a clinical trial (7).

METHODS

The following sources were searched: Ovid MEDLINE® (from 1966 to December 2006), Ovid EMBASE® (from 1980 to December 2006), CINAHL (from 1982 to December 2006), HAPI: Health and Psychosocial Instruments (from 1985 to December 2006), PsycINFO (from 1967 to December 2006), Web of Science Search History (Science Citation Index

Expanded from 1945 to December 2006, Social Sciences Citation Index from 1956 to December 2006), Biosys Previews Search (from 1980 to December 2006) Ovid HealthStar® (1966–December 2006), and ASSIA: Applied Social Sciences Indexes and Abstracts (1987–December 2006).

The following terms were used as key words in the search: Ambulatory anesthesia, day surgery, questionnaire, postoperative recovery, recovery of function, anesthetic recovery, visual analog scales, pain measurement, quality of recovery, medical outcome study, validity, and reproducibility of results. The search was limited to human studies, adult subjects, and those written in English. All studies related to the development and evaluation of early postoperative recovery outcome measurements within 1 wk after surgery were identified and reviewed.

Using Ovid MEDLINE the names of the authors of the identified papers published on functional recovery in ambulatory anesthesia were combined using the "and" function to yield the number of citations. These citations were reviewed to identify any other relevant papers. The references of all identified papers were reviewed to detect relevant information and to identify any additional pertinent papers.

Study Selection

The abstracts of all citations identified by the search strategy were independently reviewed by two of the authors (FH and JW) to confirm eligibility for inclusion. The inclusion criterion for each abstract derived from the search of the previously mentioned databases was postoperative recovery assessment instruments administered to patients within 1 wk after undergoing ambulatory surgical procedures. A third reviewer (FC) was used to resolve discrepancies.

The reviewers (FH and JW) discussed the preliminary inclusion criteria from each independently selected abstract. Full text articles selected from the first discussion were reviewed to analyze types of patients and surgical procedures, and outcomes assessed by the instrument. The quality of the identified health measurement instruments was assessed for standard psychometric properties, including the appropriateness, reliability, validity, responsiveness, precision, interpretability, acceptability, and feasibility (6). A third reviewer (FC) was used to resolve discrepancies derived from the discussions. Authors were contacted for further information not available in the manuscripts. A Medline citation search of the identified instruments was also conducted.

Exclusion Criteria

Studies with postoperative recovery outcome measurements performed more than 1 wk after surgery, health-related quality of life measurement studies in nonsurgical patients or postsurgical inpatients, publications in languages other than English were excluded.

RESULTS

Through Ovid MEDLINE®, the term Questionnaires (124,743 articles), Visual analog scales (9903 articles), pain measurement (24,578 articles), anesthesia recovery period (2644 articles), quality of recovery mp. (185 articles), medical outcome study (1365 articles) and surgical procedures/operative (1,423,942 articles), valid$ mp. (136,970 articles), reproduc$ mp. (257,190 articles), "reproducibility of results" (108,978 articles) were combined to yield 8941 articles. Postoperative care (exp) (322,311 articles) and anesthesia recovery period (9322 articles) were combined using "or" to yield 328,015 articles. Using the function "or" "reproducibility of results," valid: mp, reproduc: mp, reliab: mp yielded 445,651 articles that combined with the previous mentioned strategy and limited to English yielded 1866 articles.

The same strategy was applied using Ovid EMBASE® to yield 1635 articles, CINAHL 841 articles, PsycINFO Database 100 articles, Web of Science Search History 1222 articles, Biosys Previews Search 608 articles, Ovid Healthstar® Literature Search yielded 1305 articles, ASSIA: Applied Social Sciences Indexes and Abstracts 192 articles.

A considerable number of articles related to inpatients and nonsurgical outpatient population were excluded. Moreover, the use of instruments for assessment of postoperative recovery later than 1 wk after surgery, studies related only to patient satisfaction, intensity of pain after surgery, psychological and stress-related symptoms in the perioperative period as sole indicators of quality of recovery in the surgical patient were excluded. Thus, we included seven articles in this review (Table 1). Four of the studies included ambulatory patients only (9,11–13), whereas the other three include ambulatory and inpatients (1,8,10).

The present systematic search of publications on postoperative recovery outcome measurement tools in patients having ambulatory surgery identified seven instruments: Surgical recovery index (SRI) (8), 24-h Functional Ability Questionnaire (24-h FAQ) (9), 40-item Quality of Recovery Score (QoR-40) (10), Quality of Recovery Score. (QoR 9 Score) (1), General Symptom Distress Scale (GSDS) and Functional Status Questionnaire (FSQ) (11), Postanesthesia Short-term Quality of Life Tool (PASQOL) (12), Postdischarge surgical recovery scale (PSR) (13) (Table 1).

A Medline citation search of the identified instruments found 26 citations for QoR 9 score, 18 citations for QoR-40, 17 citations for GSDS and FSQ, nine citations for 24-h FAQ, one citation for PASQOL, one citation for SRI, and one citation for PSR. Most of the citations were from studies on ambulatory surgical patients except for QoR-40 citations, which were primarily from studies on surgical procedures involving inpatients.

Table 1. Studies Included in the Analysis

Author	Study population	Method of surveillance	Time of surveillance (days)	N	Outcome (s) assessed	Instrument (s)
Talamini, 2004 (8)	Mixed laparoscopy	Visit/mail	7–28	149	Overall pain, pain common activities, resumption activities after operation	Surgical Recovery Index (SRI) (8)
Hogue, 2000 (9)	Mixed ambulatory	Visit/phone	1	1334	Preoperative expectations, pain, vomiting, nausea, reduced alertness, patient satisfaction	24-Hour Functional Ability Questionnaire (24h FAQ) (9)
Myles, 2000 (10)	Mixed	Visit/mail	1	160	Emotional state, physical comfort, psychological support, physical independence, Pain	40-item Quality of Recovery Score (QoR-40) (10)
Myles, 1999 (1)	Mixed ambulatory inpatients	Visit/phone	Cohort A DS: 3 h Minor: 25 h Major: 113 h Cohort B 6 wk	451	Quality of recovery, 61 designed items	Quality of Recovery Score. (QoR 9 Score) (1)
Swan, 1998 (11)	HRS laparoscopy ambulatory	Visit/phone	7	100	General Symptom distress, functional status	General Symptom Distress Scale (GSDS) and Functional Status Questionnaire (FSQ) (11)
Oakes, 2002 (12)	Mixed ambulatory	Mail/phone	5–7	50	Physical, psychological and role of function aspects of HRQL related to the anesthesia experience after surgery	Postanesthesia Short-term Quality of Life Tool (PAS QOL) (12)
Kleinbeck, 2000 (13)	Mixed ambulatory	Mail/visit	1–4	171	Health status, activity, fatigue, work ability, expectations	Postdischarge surgical recovery (PSR) scale (13)

Mixed = multiples types of surgery; HRS = hernia repair surgery; Mail = mail-in questionnaire; Visit = interview or follow-up visit; Phone = telephone contact; PRS = postoperative recovery; ADL = activities of daily living; HRQL = health related quality of life.

Appropriateness

Is the content of the instrument appropriate to the questions which the clinical trial is intended to address? Aspects of life important to patients were considered in the pretest of the scale's developmental process in most of the analyzed papers (Table 3). The most important determinants of quality of recovery have been proposed to be cognitive functioning, energy/fatigue/sleep, mental health, pain, physical functioning, psychological functioning, psychosocial functioning, side effects of analgesics, and symptoms (5).

The item-generation process was described in most of the papers; however, the item-selection process was not well described in some of the studies (Table 2).

Some instruments do not assess all aspects of postoperative quality of life. The SRI (8) lacks assessment of side effects of analgesics, symptoms related to the postoperative period, mental health, energy, fatigue, and sleep focusing mostly on pain and activities of daily living as indicators of activity resumption. The PSR does not assess mental health, and side effects of analgesics.

Some of the instruments were evaluated for specific surgical procedures e.g., hernia repair or laparoscopy, and may not comprehensively sample all aspects of quality of recovery across other types of surgical procedures (8,11).

The GSDS used in Swan et al.'s (11) paper was developed as a home care outcome measure and the FSQ was developed for ambulatory internal medicine clinics, not postoperative surgical patients. The QoR 9 and QoR-40 included both in-patients and ambulatory surgical patients; 23% of patients in the QoR 9 development were ambulatory patients and only 16% of patients in the QoR-40 were ambulatory patients.

In summary, quality of recovery is an integral part of the assessment of postoperative quality of life and although the importance of each of many inputs to overall quality of recovery has been not fully elucidated, the instruments analyzed assess many of the determinants of quality of recovery (Table 3).

Reliability

Does the instrument produce results that are reproducible and internally consistent? The instruments analyzed in this review demonstrated variable reliability (Table 2). The reliability of Myles et al.'s (1) nine item QoR 9 Score was moderate (0.61) but not high enough to detect changes within individuals. It has been recommended that a reliability level of at least 0.90 is required for a measure if it is to be used for decisions about an individual on the basis of score (7).

Table 2. Item Generation Process (IGP), Validity, Reliability and Responsiveness

Author	Instrument(s)	IGP described	Validation methods	Reliability methods	Responsiveness
Talamini, 2004 (8)	Surgical Recovery Index (SRI) (8)	Yes	Content and Construct validity	Cronbach α for Internal consistency	Not described
Hogue, 2000 (9)	24-Hour Functional Ability Questionnaire (24hFAQ) (9)	Yes	Content (experts opinion), Construct (interitem correlation) and Discriminant validity (patients satisfaction)	Not described	Not de scribed
Myles, 2000 (10)	40-item Quality of Recovery Score (QoR-40) (10)	Yes	Convergent (QoR-40 vs VAS and interitem correlation) Construct (between men and women, and association between QoR-40 and time for compl etion and PACU and Hospital stay)	Test-retest, Internal Consistency and Split-half reliability	Measurement of standardized response means
Myles, 1999 (1)	Quality of Recovery Score (QoR 9 Score) (1)	Yes	Convergent (QoR vs VAS), Construct (QoR score in different surgical subgroups and association between QoR and time for completion and PACU and Hospital stay)	Interrater agreement, Test–retest, Internal consistency (Cronbach α) and Split-half reliability	Medians in Cohort B between minor and major surgeries
Swan, 1998 (11)	General Symptom Distress Scale (GSDS) and Functional Status Questionnaire (FSQ) (11)	No	Not described	Internal consistency (Cronbach α)	Not described
Oakes, 2002 (12)	Postanesthesia Short-Term Quality of Life (PASQOL) (12)	No	Content (interrater agreement and content validity index) Construct (discriminant, convergent and divergent)	Internal consistency (Cronbach α)	Not described
Kleinbeck, 2000 (13)	Postdischarge surgical recovery scale (PSR) (13)	Yes	Content validity Concurrent validity (PSR vs Wolfer–Davis Recovery Inventory) (inpatients)	Interrater reliability	Not described

IGP = item generation process; PACU = post anesthesia care unit; VAS = visual analog scale.

The same authors' subsequent 40-item questionnaire, the QoR-40, reported better reliability (10). One instrument, the 24-h FAQ, did not assess reliability.

Validity

Does the instrument measure what it claims to measure? All of the instruments analyzed in this review were tested for validity with the exception of the GSDS and FSQ, which were previously validated in home care patients and ambulatory internal medicine patients, not postoperative surgical patients. Validity testing of the SRI showed a significant number of floor and ceiling effects in pain and activity resumption questions, which are indicators of poor content validity. These questions should have been eliminated. Concurrent validity of the PSR with the Wolfer–Davis Recovery Inventory, an instrument developed in 1970 for inpatients having major surgery (14), was moderate (0.76).

Responsiveness

Does the instrument detect changes over time that matter to patients? Responsiveness to change was assessed by only two of the instruments, i.e., the QoR

Table 3. Determinants of Quality of Recovery Described in the Papers

Instruments	SRI (8)	24hFAQ (9)	QoR-40 (10)	QoR 9 (1)	GSDS and FSQ (11)	PASQOL (12)	PSR (13)
Determinants Cognitive functioning	✗	✔	✔	✔	✔	✔	✗
Energy/fatigue/sleep	✗	✔	✔	✔	✔	✔	✔
Mental health	✗	✗	✗	✗	✔	✔	✗
Pain	✔	✔	✔	✔	✗	✗	✔
Physical functioning	✔	✗	✔	✗	✔	✔	✔
Psychosocial functioning	✗	✗	✗	✔	✔	✔	✔
Side effects of analgesics agents	✗	✔	✔	✔	✔	✗	✗
Symptoms	✗	✔	✔	✔	✔	✔	✗

24hFAQ = 24-hour functional ability questionnaire; FSQ = functional status questionnaire; GSDS = general symptom distress scale; QoR = quality of recovery score; SRI = surgical recovery index; PSR = post discharge surgical recovery scale.

Table 4. Criteria Assessed and Recommendations

	SRI (8)	24hFAQ (9)	QoR-40 (10)	QoR 9 (1)	GSDS and FSQ (11)	PASQOL (12)	PSR (13)
Appropriateness	✗	✔	✔	✔	✗	✗	✗
Precision	✔	✔	✔	✔	✔	✔	✔
Interpretation of the scores	✗	✗	✔	✔	✗	✔	✗
Authors recommendations for use	Differences in recovery among patients having laparoscopic or open surgery	To measure ability to return to normal functioning after ambulatory hernia repair or laparoscopic surgery	Perioperative clinical studies and to assess impact of changes in health delivery on quality of care	Postoperative recovery audit for QA purposes	Not validated for ambulatory surgery	HRQL specifically related to the anesthesia experience after surgery	Self-report measure of recovery in ambulatory surgical patients

24hFAQ = 24-hour functional ability questionnaire; FSQ = functional status questionnaire; GSDS = general symptom distress scale; HRQL = health related quality of life; QoR = quality of recovery score; SRI = surgical recovery index; PSR = post discharge surgical recovery scale.

9 and QoR-40. Responsiveness to change was not assessed by the other instruments.

Precision

How precise are the scores of the instrument? The PASQOL instrument is a 40-item questionnaire with a horizontal visual analog scale (VAS). The 24-h FAQ is a 21-item questionnaire consisting of 4–9 Likert response categories, and Binary response categories and VAS. The QoR 9 and QoR-40 consist of 9 and 40 questions with three point scale and five Lickert response categories respectively. The SRI consists of eight questions regarding pain, and 16 questions regarding activity resumption on a three-point scale. The GSDS consists of 11 items scored on a four-point scale, and the FSQ consists of 34 questions grouped into six multi-item scales scored on ordinal scales from one to four or one to six. The PSR is a 15-item 10-point semantic differential scale.

The format of response categories is one of the main influences of the precision of an instrument (7). There is some evidence that the use of seven rather than five response categories increases precision. However, there is little evidence of superiority of VAS over Likert scales (15).

Interpretability

How interpretable are the scores of an instrument? The interpretability of the identified measures was not always self-evident, and the authors did not always provide enough information on how to interpret changes in the scores in the manuscript (Table 4).

Acceptability

Is the instrument acceptable to patients? The response rate for the SRI was only 50%. The nonresponse rate for the FSQ and GSDS was 23%. The PASQOL questionnaire was returned by 74% of participants. Complete questionnaire data were available for 93% of patients in the 24-h FAQ. The completion and return rate of the QoR-40 was 87% and the mean time for completion was 6.3 min, with 89% completing the questionnaire within 10 min.

It is essential that a patient-based outcome measure be acceptable to patients in order to minimize any distress as patients recovering from surgery may have pain or other postoperative adverse effects such as nausea. The acceptability of an instrument will help ensure high response rates (7). Acceptability has been described as " a description of the speed of completion of the questionnaire and the proportion of patients who find it difficult, impossible or unacceptable for any reason" (16).

Feasibility

Is the instrument easy to administer and process? The time and resources necessary to collect, process, and analyze a patient-based outcome measure are important to consider (7). The QoR 9 was the most frequently cited measure.

DISCUSSION

The use of patient-based outcome measures has become increasingly important in the evaluation of health care (6). Our citation search showed that clinical trials in ambulatory anesthesia used several instruments to evaluate postoperative recovery. It is important for clinical investigators to select instruments that are suitable for the intended task. The lack of consistency in the selection of measures for clinical trials hinders comparisons among studies (7). The quality of health measures is important, as their use in collecting information influences clinical decision making. The content and relevance to the purpose of the trial need to be considered when choosing questionnaires for clinical trials (4). The use of a patient-based outcome measure as one of the end-points of a clinical study requires that the instrument has fulfilled the requirements of appropriateness, reliability, validity, responsiveness, precision, interpretability, acceptability, and feasibility.

Adequate assessment of quality of recovery is important as an end-point for outcome research and clinical trials, and for reduction of hospital stay and convalescence, as well as quality assurance and patient satisfaction. Morbidity after ambulatory surgery, such as unanticipated admissions and delayed discharge, can affect functional recovery. Moreover, many aspects of quality of recovery might affect postoperative quality of life (5).

The assessment of postoperative quality of recovery is a challenging process and requires psychometrically developed instruments, which can accurately capture the complexity of the concept quality of recovery. Because of the multidimensional nature of the recovery process, the instrument psychometrically created involves assessment of the reliability, validity, and responsiveness (17). The development of instruments for assessing quality of recovery is difficult, as there is no criterion or "gold standard" for comparison (1). However, there are many generic and disease-specific, health-related quality of life instruments that have been validated in patients with chronic illnesses (e.g., SF-36).

Verbal analog scales and VAS have been widely used for assessing a significant number of postoperative outcomes such as pain, emesis, and fatigue (18). VAS has good validity, reliability, and responsiveness to change, compared to multi-item questionnaires, for measuring quality of life in chronic medical diseases (19). Moreover, VAS have been used in the reliability and validity testing of current scales designed for quality of recovery due to the lack of a gold standard in this area (1,10). However, VAS has not been validated for the assessment of quality of recovery after ambulatory anesthesia and surgery. Other validated scales with a broader scope of outcome assessment would enable better evaluation of the quality of life measurement in health research (4).

In addition, the literature is scant on the influence of different variables on complete recovery after discharge (20) and QoR tends to return to preoperative values at approximately 7 days after surgery (1). For this reason, instruments administered more than 7 days after surgery were excluded.

A postoperative QoR instrument should incorporate the dimensions of physical functioning, mental health, cognitive functioning, symptoms, role and social functioning, general health perceptions, sleep, and energy (5). Instruments for QoR should include the assessment of aspects of life that patients value. The construction of a psychometric questionnaire should initially involve an item generation and selection process that includes important elements of patient recovery (8).

One of the limitations of this review is that only English language instruments were identified. We did not examine non-English postoperative recovery outcome measures.

In conclusion, it is essential that the development of instruments to assess recovery after ambulatory surgery and anesthesia follow a rigorous process from the item generation process to the assessment of reliability, validity, and responsiveness in the intended patient population and clinical setting (21,22). As well, guidelines for interpretation of the scores and specific suggestions should be included to enhance the applicability of the instruments. In addition to fulfilling the above criteria, it is essential that instruments be acceptable to patients in order to minimize their distress in recovering from anesthesia and surgery, and also to obtain high response rates to questionnaires, minimizing bias from nonresponse. Thus, the instrument should be feasible to administer to postoperative patients. It is only when these criteria are confirmed that the clinician or researcher should use the instrument for a clinical trial or for quality assurance evaluations.

The use of a standardized instrument across clinical trials for ambulatory surgery and anesthesia would allow better comparisons among trials. The QoR-40 was the only instrument that fulfilled all of the above criteria; however, our citation search showed that the QoR-40 was used primarily for studies involving inpatients, whereas only one of the citations was for ambulatory surgery. The QoR 9 was the most frequently cited instrument, most of which were for ambulatory surgery; however, the QoR-40 is a better instrument. The QoR-40 was not specifically developed for use in ambulatory surgical patients, and thus the selection of the QoR 9 rather than the QoR-40 may be related to the feasibility of administering a longer (i.e., 40-item questionnaire) to ambulatory patients. The QoR-40 may be most suitable for use in clinical trials or for inpatients; however, the feasibility of administering a 40-item questionnaire may be problematic as a quality assurance outcome measure.

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