The Postoperative Recovery Profile (PRP) – a multidimensional questionnaire for evaluation of recovery profiles

Renée Allvin, RNA, MScN

Department of Anaesthesiology and Intensive Care, Örebro University Hospital, School of Health and Medical Sciences, Örebro University, Centre for Evidence Based Medicine and Assessment of Medical Technology Örebro, Centre for Health Care Sciences, Örebro University Hospital, Örebro, Sweden.

Elisabeth Svensson, PhD, Professor

Statistics of Swedish Business School, Örebro University, Örebro, Sweden

Narinder Rawal, MD, PhD, Professor

Department of Anaesthesiology and Intensive Care, Örebro University Hospital, School of Health and Medical Sciences, Örebro University, Örebro, Sweden.

Margareta Ehnfors, RNT, DMSc, Professor, FACMI

School of Health and Medical Sciences, Örebro University, Örebro, Sweden.

Anna-Maria Kling, MSc

Statistical and Epidemiology Unit, Örebro University Hospital, Örebro, Sweden

Ewa Idvall, RNT PhD, Associate Professor

Kalmar County Council, Department of Medical and Health Sciences, Linköping university, Linköping, School of Health and Medical Sciences, Örebro University, Örebro, Sweden

Correspondence to:

Renée Allvin

Department of Anaesthesiology and Intensive Care

Örebro University Hospital

Örebro 701 85

Sweden

Phone: # 46 10 602 1000 (business), # 46 19 143711 (home)

Fax: # 46 19 12 79 74

E-mail: rene.allvin@orebroll.se

Abstract

Background. The previously developed Postoperative Recovery Profile (PRP) questionnaire is intended for self-assessment of general recovery after surgery. The aim of this study was to further evaluate the questionnaire regarding the construct validity and ability to discriminate recovery profiles between groups. Furthermore, the item variables of greatest importance during the progress of recovery were investigated.

Methods. Postoperative recovery was assessed during the period from discharge to 12 months after lower abdominal- and orthopedic surgery. Construct validity was evaluated by comparing the assessments from the PRP-questionnaire and a global recovery scale. Recovery profiles of the diagnose groups were displayed by the cumulative proportion recovered participants over time. The importance of item variables was investigated by ranking ordering.

Results. A total of 158 patients were included. The result showed that 7.6 % of all possible pairs were disordered when comparing the assessments from the PRP questionnaire and the global recovery scale. Twelve months after discharge 51 % participants in the abdominal group were fully recovered, as compared with the 73%, in the orthopedic group (95% CI: 6 % to 40 %). The item variable *pain* appeared as top five at eight measurement occasions of eight possible in both the abdominal and the orthopedic groups. The importance of the items was emphasized.

Conclusions. The PRP questionnaire allows for evaluation of the progress of postoperative recovery, and can be useful to assess patient-reported recovery after surgical treatment. Knowledge about recovery profiles can assist clinicians in determining the critical time points for measuring change.

Background

Any surgical treatment is followed by a period of postoperative recovery. Traditionally, studies of recovery after surgery and anesthesia have primarily focused on clinically oriented endpoints, e.g. length of hospital stay (1), decrease of physical symptoms (2, 3), and the incidence of adverse events (4). Few studies examine patient-reported outcomes, such as patient preferences or functioning, well being issues and patient satisfaction, neither during the immediate postoperative period nor in a longer perspective. However, the importance of evaluating both biomedical and patient-reported outcomes in the assessment of the result of surgical treatment has been emphasized (5).

A prerequisite to assess and evaluate postoperative recovery is the use of valid instruments. A systematic review on general postoperative recovery-specific questionnaires and their measurement properties (6), compared with predefined quality criteria (7), demonstrated that no fully validated questionnaires were available (6). Two instruments, the Post Discharge Surgical Recovery scale (8, 9) and the Quality of Recovery-40 (8, 9) were considered as superior and were recommended in studies for short-term postoperative recovery. A review of recovery outcome measurements after ambulatory surgery (10), also performed to assess the available questionnaires for predefined quality criteria (11), reported that only the Quality of Recovery-40 (9) fulfilled all criteria although not specifically developed for ambulatory surgery. A modified version of the QoR-40 has recently been tested for ambulatory patients (12). For a majority of recovery questionnaires the only information given is one study with a description of the development and first steps in the validation process (6).

In our previous studies we have carried out a concept analyses of postoperative recovery, resulting in a theoretical definition of the concept and identification of different recovery

dimensions (13). As a complement we have studied patient's, nurses and surgeons subjective experiences of postoperative recovery up to one year after surgery (14). On the basis of these studies the Postoperative Recovery Profile (PRP) questionnaire, consisting of 19 items distributed in five recovery dimensions (physical symptoms, physical functions, psychological, social and activity), was developed. Support was given for good content validity and intra-patient reliability (15). The PRP questionnaire is intended to be a discriminative and evaluative scale for self-assessment of general postoperative recovery after surgical procedures. To present information on adequate measurement properties several studies are required. Therefore, the aim of this study was to further evaluate the PRP questionnaire regarding the construct validity and its ability to discriminate recovery profiles between different groups of patients. Furthermore, the item variables of greatest importance, according to the patients, were investigated. Hence, in this study the evaluations are mainly focused at group related recovery profiles.

Patients and methods

Sample

Study participants were recruited from a University hospital in the centre of Sweden. Male and female in-patients, older than 18 years, undergoing elective lower abdominal surgery (colorectal surgery, radical prostatectomy or abdominal hysterectomy) and orthopedic surgery (knee- or hip replacement) were consecutively included in the study during the period September 2006 to July 2007. Patients were excluded if they had poor Swedish comprehension, cognitive dysfunction that precluded complete cooperation, or any severe pre-existing medical condition that limited objective assessment after surgery. After admission the day before surgery, patients were given oral and written information and asked if they were willing to participate in the study. Approval for the study was obtained from The

Regional Ethical Review Board in Uppsala (2006/047). A total of 172 patients were approached for participation.

Data collection

All participants were asked to complete the PRP questionnaire, which contained the 19 item variables formulated as statements, e.g. “Right now I experience ... pain. A four-point scale, with the verbal descriptive response categories *none*, *mild*, *moderate* and *severe* were used. Our operational definition of the level of recovery was based on the number of items (indicator sum) responded with *none*. The criterion for fully recovered was decided to be the indicator sum of 19 (all items responded with *none*). Furthermore, to evaluate construct validity, an alternative global assessment of recovery was used. The participants were asked to rate their overall postoperative recovery using a single global recovery scale with the five verbal descriptive categories *fully recovered*, *almost fully recovered*, *partly recovered*, *slightly recovered*, *not at all recovered*. In order to evaluate the item variables participants valued as most important during the recovery process a ranking list was compiled (e.g., “It is of importance not experiencing pain after surgery”, or “It is of importance to be able to sleep after surgery”). On each measurement occasion participants were asked to value five of the 19 item variables in the PRP questionnaire as most important.

These measurements were done on six occasions, before discharge, day 3, day 10, 1 month, 2 months, and 3 months after discharge. In addition to this, the ranking list was completed the day before surgery. Those participants that according to the PRP questionnaire assessment were not regarded as fully recovered three months after discharge completed the same questionnaires monthly until they were assessed as fully recovered, maximum up to 12 months. The questionnaires were given to the participants at the hospital, and sent monthly

(one month up to maximum 12 months after discharge) to their home addresses by regular mail. Non-responders received one reminder. Furthermore, perioperative data, e.g., details of surgery and anesthesia, and total hospital stay were collected. Data were collected between September 2006 and July 2008. In this paper the data sets from the 3-month assessment were used for evaluation of construct validity and the 1- to 12-months follow-up occasions for evaluation of ability to discriminate between groups. In the evaluation of item variables valued as most important the data sets from before surgery, before discharge, day 10, months 1, 3, 6, 9, and 12 were used.

Data analysis

A rank-based statistical method (16), developed for evaluation of paired ordered categorical data from rating scales was used to evaluate consistency between the assessments on the PRP questionnaire and the global recovery scale at the 3-months follow-up occasions. This method is based on a bivariate ranking approach, which means that observations are regarded as tied only for identical pairs of observations. In case of complete rank order consistency between the PRP assessments and the global scale of recovery the two sets of bivariate ranks will be identical. In that case, the plot of the paired classifications shows that the ordering of all pairs is unchanged when changing scales. This is the rank-transformable pattern of agreement (RTPA). A total order consistency in paired assessments rarely occurs in studies. The measure of disorder (D), which is the ratio of the proportion of disordered pairs among all possible combinations of pairs, was calculated. Possible values range from 0 (total order) to 1 (total disorder).

The number of months the participants needed for being perceived as fully recovered according to the assessments on the PRP questionnaire (indicator sum 19) was studied by

means of recovery profiles. The recovery profiles of the diagnose groups were displayed by the cumulative proportion recovered participants over time (Kaplan-Meier curve) (17). When participants discontinue before complete recovery or before end of the study, information about the recovery time is lacking. The only information given is that the recovery period will be longer than the time of participation. Such participants are called censored observations. The Kaplan-Meier analysis takes account of the information from these participants up to the time they were censored. The difference in proportions recovered patients between the two profiles on 12-month follow-up occasions was evaluated by means of the 95 % confidence interval (CI).

A ranking list, based on the participant's appraisal of the five most important item variables in the PRP questionnaire, was compiled to illustrate the rank ordering of the items.

Results

Of the 172 patients approached in this study there were 14 refusals (recruitment rate 92 %). A total number of 158 patients were included; of these 6 patients dropped out before discharge. Patient demographics are presented in Table 1.

Table 1. Patient demographics (median (range) or number (%))

		Orthopedic surgery (n=75)	Lower abdominal surgery (n= 83)	
Age (yr)		66 (36-87)		61 (18-88)
Sex (M/F) (% male)		27/48 (36)		43/40 (52)
ASA status (n (%))				
I		23 (31)		34 (41)
II		49 (65)		47 (57)
III		3 (4)		2 (2)
Type of surgery (n (%))	Hip replacement	48 (64)	Hysterectomy	17 (21)
	Knee replacement	27 (36)	Prostatectomy	21 (25)
			Colorectal	45 (54)
Duration of surgery (min)		102 (65-177)		135 (60-480)
Type of anesthesia (n (%))	GA	8 (11)	GA	42 (51)
	GA+PNB	7 (9)	GA+EDA	37 (45)
	EDA+IT	12 (16)	GA+IT	4 (5)
	IT	13 (17)		
	IT+PNB	35 (47)		
Length of hospital stay (d)		6 (3-11)		4 (1-28)

GA= General anesthesia, PNB= Peripheral nerve block, EDA= Epidural block, IT= Intrathecal block

The evaluation of agreement between the indicator sum of recovery and the assessment with the global recovery scale included only the participants that responded to all 19 items in the PRP questionnaire and the global recovery assessment (n=120). Of the 38 participants that were excluded in the analysis 19 had discontinued their participation before the 3-month assessment. The frequency of non-response per item variable, among the remaining 19 participants varied from seven (*sexual activity*) to one (*feeling down, dependence on others, feeling lonely/abandoned, re-establish everyday life, social activities*).

Figure 1a. Assessment of postoperative recovery 3 months after discharge. Agreement between the indicator for level of postoperative recovery (0-19) and a global assessment of level of postoperative recovery (A = Not recovered at all, B = Slightly recovered, C = Partly recovered, D = Almost fully recovered, E = Fully recovered), n=120.

The pattern of agreement that is expected in the case of complete order consistency between the two different ways of recovery assessments is shown in Figure 1b. The observed pattern of agreement (Figure 1a) is dispersed from this RTPA. The measure of disorder (D) was 0.076, which means that 7.6 % of all possible pairs were disordered when comparing the two methods of measuring postoperative recovery. Hence, according to this study it can be expected that the indicator sum 19 will correspond to assessments of *fully recovered* on the global recovery scale. Correspondingly, *almost fully recovered* will correspond to indicator sums between 15 and 18, and the range of sums from 8 to 14 will correspond to *partly recovered*, see Figure 1b and Table 2. The limits are not mutual exclusive.

Figure 1b. Assessment of postoperative recovery 3 months after discharge. The rang-transformable pattern (RTPA) for agreement between the indicator for level of postoperative recovery (0-19) and a global assessment of level of postoperative recovery (A = Not recovered at all, B = Slightly recovered, C = Partly recovered, D = Almost fully recovered, E = Fully recovered), n=120.

Table 2. Classification of indicator sums into recovery levels

Global scale	Indicator sum (PRP questionnaire)
Fully recovered	19
Almost fully recovered	15 - 18
Partly recovered	8 - 14
Slightly recovered	7
Not recovered at all	< 7

The Kaplan-Meier curve illustrates the postoperative recovery profiles according to the PRP assessments during the twelve months after discharge for the groups of abdominal and orthopedic patients (Figure 2). The occurrence of censored observations and number of not recovered, respectively recovered participants are shown in Table 3. The largest increase in the proportion of recovered patients was seen between the 2-month and the 3-month follow-up occasions; from 21 % (SE, 5%) to 36 % (SE, 6%) in the abdominal group, and from 13% (SE, 4%) to 31% (SE, 5%) in the orthopedic group, respectively. On the 2- and 3-month

follow-up occasions the proportion of recovered patients of the abdominal group was larger than the group of orthopedic participants, the opposite hold for the remaining follow-up occasion. Twelve months after discharge a larger proportion patients, 73% (SE, 6%), in the orthopedic group were fully recovered according to the indicator sum, as compared with the 51 % (SE, 6 %) participants in the abdominal group. The 95 % CI of this difference was wide, but significant, ranging from 6 % to 40 %. After month eight in the abdominal group, and 11 months in the orthopedic group, respectively, no additional participant reached the level of fully recovered during the 12-month study period.

Table 3. Occurrence of censored observations, number of not recovered, respectively recovered participants

Time to be fully recovered (months)	Lower abdominal surgery (n=77)		Orthopedic surgery (n=73)	
	Not recovered participants (n)	Recovered participants (n)	Not recovered participants (n)	Recovered participants (n)
1	76*	6	70	5
2	69	10	65	4
3	59*	11	61+	13
4	45*	1	46+	6
5	41	1	33+	4
6	40*	2	30	1
7	37	3	29	6
8	34*	3	23+	2
9	*	-	20+	1
10	*	-	17+	1
11	*	-	15	3
12	*	-	+	-

*Censored observation(s) lower abdominal participants

+ Censored observation(s) orthopedic participants

Figure 2. Kaplan-Meier curves illustrating postoperative recovery profiles after abdominal- ($n=83$) and orthopedic surgery ($n=75$).

The result of the participant's assessments of the five most important item variables during the recovery process demonstrated that all 19-item variables were covered at all measurement occasions. The ranking lists, compiled from the participant's judgments, showed that each of the five recovery dimensions contained top five rank item variables (Table 4). All participants that completed the ranking lists were included in the analysis. The variable *pain* appeared as top five at eight measurement occasions of eight possible in both study groups. Other variables ranked as top five at eight occasions were *gastrointestinal function* in the lower abdominal group, and *mobilization* and *personal hygiene* in the orthopedic group. Apart from *pain*, the occurrence of item variables as top five varied between the two study groups.

Table 4. Item variables in the PRP-questionnaire ranked as most important (1 (most important) to 19). The top five item variables are presented in bold numbers.

In bold numbers:																	
Dimension	Item	Orthopedic surgery							Lower abdominal surgery								
		Pre n=73	BD n=69	D 10 n=72	M 1 n=68	M 3 n=67	M 6 n=28	M 9 n=19	M 12 n=11	Pre n=83	BD n=72	D 10 n= 75	M 1 n=72	M 3 n=65	M 6 n=37	M 9 n=29	M 12 n=23
Physical symptoms	Pain	2	1	1	1	1	2.5	1	1.5	1	1	1.5	1	1	2	1	2.5
	Nausea	12	6.5	7	10	10	11.5	3	7	8	5	13.5	11	11	12.5	13.5	12
	Fatigue	18	6.5	11	13.5	13	19	17	18.5	15	11	8	12	9.5	12.5	10.5	14
	Appetite change	17	14	12	13.5	14.5	17.5	17	14.5	16	12	9	15	13	11	13.5	16
	Sleeping difficulties	5.5	4	4	3	4	6	11	4	10	6	3	4	8	4	6	8
Physical functions	Gastrointestinal function	4	5	8	7.5	11.5	9	12	6	2	2	4	2	2	1	3.5	2.5
	Bladder function	11	9.5	15	19	14.5	15.5	14	7	7	9	13.5	10	14	14.5	10.5	10.5
	Muscle weakness	18	15.5	13.5	7.5	9	7	8.5	7	18	17.5	17	17	18	17.5	16	14
	Sexual activity	19	18.5	18	15.5	16.5	15.5	17	18.5	13.5	15	13.5	14	9.5	6	3.5	4.5
	Mobilization	1	2	2	2	2	1	2	3	4	3	1.5	3	3.5	7	5	4.5
Psychological	Anxiety and worry	5.5	9.5	9.5	9	7	9	5	14.5	3	7	6	5	3.5	5	2	1
	Feeling down	14	18.5	16.5	12	11.5	11.5	8.5	14.5	8	8	10.5	7.5	12	3	7.5	7
	Feeling lonely	13	12	13.5	15.5	18	13.5	14	14.5	5	10	16	13	16	14.5	16	14
	Difficulties in concentration	15.5	15.5	19	18	19	17.5	19	14.5	19	17.5	19	18	19	17.5	18.5	19
Social	Social activities	9	8	9.5	11	8	9	11	6	11	13	7	9	5	9	10.5	9
	Dependence on others	7	11	5	5	5	2.5	6	7	13.5	14	13.5	16	15	16	16	17.5
	Interested in surroundings	15.5	17	16.5	17	16.5	13.5	14	14.5	17	19	18	19	17	19	18.5	17.5
Activity	Re-establish everyday life	10	13	6	6	6	5	6	6	12	16	10.5	6	6.5	9	10.5	10.5
	Personal hygiene	3	3	3	4	3	4	4	1.5	6	4	5	7.5	6.5	9	7.5	6

Pre= Preoperative, BD= Before discharge, D= Day, M= Month

Discussion

The result from the evaluation of the PRP questionnaire shows good construct validity and an ability to discriminate recovery profiles between different groups. Furthermore, the importance of the item variables was emphasized. To our knowledge, this is the first time a multi-dimensional questionnaire, classifying different levels of recovery (from *not recovered at all* to *fully recovered*), has been proposed for self-assessment of postoperative recovery, see Table 2.

As there is no gold standard for measuring postoperative recovery a five-point global recovery scale was used to evaluate the interchange ability between the PRP questionnaire and the global recovery scale. The item scales of the PRP questionnaire cover different aspects of the same variable. Therefore, a single global scale (18) is valuable as a measure of postoperative recovery. In the evaluation of agreement between the PRP questionnaire and the global recovery scale the result demonstrated that only 7.6 % of all possible pairs of assessments were disordered when comparing the two methods of assessment, which gives support for good construct validity. The definition of fully recovered as indicator sum 19 (all items answered with *none*) is a strict definition, irrespective of this we deliberately decided to use this limit in the comparison of the assessments. The rank transformable pattern was used for identification of the cut-off between the comparable sets of categories. This demonstrated how the five categories in the global recovery scale correspond with the indicator sums. As in most empirical data sets cases of overlapping pairs in the RTPA will occur, and as seen in Figure 1b two indicator sums were not univocally related to a certain recovery category. We decided to place these indicator sums in the lowest category in the overlap, see Table 2. When using the PRP questionnaire in forthcoming studies, it might be preferable with fewer scale categories and thus a less strict definition of being fully recovered. However, as much as 31 %

of the participants regarded as fully recovered according to the global recovery scale, were not assessed as fully recovered according to the indicator sum. Our findings indicates that patient's perception of fully recovered also might contain individual factors not easily covered by a questionnaire. Forthcoming empirical studies will show the validity of our findings. In this test of construct validity the three-month measurements was used. However, the result could be extrapolated to other periods in time.

The evaluation of ability to discriminate recovery profiles between groups concerned different types of surgery. The PRP questionnaire could also be used to compare recovery profiles after e.g., different surgical techniques (laparoscopic vs. open surgery), or different nursing and physiotherapist interventions, as well as recovery profiles out of a gender perspective. Evaluation of changes in intra-patient profiles will be reported in forthcoming papers. Furthermore, the result demonstrated that the PRP questionnaire could be used for follow-up in a longer perspective. Today, there is a lack of studies evaluating patient-reported postoperative recovery longer than 3-monhts post-surgery (19-21). Of the available instruments found, only one had been used for 12-months follow-up, in this case after nephrectomy (22). Although it is easy to specify the start of the recovery process, it might be difficult to determine an achieved condition as the end, as the achieved condition could involve changes, both desired and less desired, compared to the initial condition (15).

The analysis of important item variables showed that all item variables were covered at all measurement occasions. This indicates that no item variable was considered as being unimportant, which gives further support for content validity previously found to be good (15). In both the abdominal and the orthopedic group *pain* was ranked as number 1 or 2 among the top five item variables at each measurement occasion. Pain has been shown to be a

major concern for patients before undergoing surgery (23). Furthermore, efforts have been put in the ambition to inform the general public about the importance, and possibilities to treat pain. Acute pain services have been established in hospitals in several countries (24), and postoperative pain and pain treatment modalities have been studied in a large number of scientific studies (25). The result also shows that the item variables ranked as top five varied during different periods of the recovery process. For example, the item *anxiety and worry* did not occur as top five until the 1 to 12-month measurement occasions in the abdominal group. This information is interesting since the major part of the recovery process takes place in the home environment, without the presence of health care professionals. This investigation gave a first insight in the participant's opinion regarding the importance of individual item variables. Hence, we have a longitudinal study in progress evaluating the importance of each item variable.

Conclusion

This study showed good construct validity and an ability to discriminate between recovery profiles in different groups. The study also emphasizes the importance of the item variables. The PRP questionnaire allows for evaluation of the progress of the postoperative recovery process, and could be useful to assess patient-reported recovery after surgical treatment. Knowledge about recovery profiles can assist clinicians in referencing patient progress and determining the critical time points for measuring change. It could also be valuable in the development of patient information activities and discharge planning protocols.

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