Patient function and caregiver burden after ambulatory surgery: a cohort study of patients older than 65

Le fonctionnement du patient et le fardeau de l'aidant après une chirurgie ambulatoire: une étude de cohorte de patients âgés de 65 ans et plus

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Abstract

Purpose The primary objective of this prospective cohort study was to assess the impact of ambulatory surgery on patient function one week and one month following surgery among surgical patients ≥ 65 yr of age. Secondary objectives were to determine whether changes in patient function were correlated with increased burden of care in the patient's primary caregiver and with patient assessments of postoperative pain and quality of life.

Presentation Abstracts of this work were presented at the 2012 Canadian Anesthesiologists' Society Meeting, Quebec City, QC.

Author contributions All authors contributed to the concept and design of the trial, reviewed the analyses, and participated in the preparation of the submitted manuscript. Gregory L. Bryson, Barbara Power, Monica Taljaard, and Howard J. Nathan secured funding. Gregory L. Bryson, Natalie A. Clavel, and Rebecca Moga conducted or supervised patient recruitment and data collection. Monica Taljaard conducted the statistical analysis with the collaboration of Gregory L. Bryson. Dr. Bryson had full access to the study data and takes responsibility for the integrity of the data and the accuracy of the data analysis.

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Methods Following Research Ethics Board approval, patients aged ≥ 65 yr undergoing elective ambulatory surgery and their caregivers were recruited. Patients completed the système de mesure de l'autonomie fonctionnelle (SMAF) and the Brief Pain Inventory. Primary caregivers completed the Zarit Burden Interview (ZBI). All measurements were obtained preoperatively and on postoperative days (POD) 7 and 30.

Results Patient function decreased on POD 7 and had not returned to baseline on POD 30 (mean change in SMAF 6.9; 95% confidence interval (CI) 5.3 to 8.4 on POD 7 and mean change in SMAF 2.6; 95% CI 1.3 to 4.0 on POD 30). Interval changes in caregiver burden were not significant (mean change in ZBI -0.4 ; 95% CI -1.8 to 0.96 on POD 7 and mean change in ZBI -0.6 ; 95% CI -2.1 to 0.8 on POD 30). Decreased patient function was associated with increased caregiver burden at all time points ($P < 0.001$). Decreased caregiver function at baseline was also associated with higher ZBI (linear association 0.71 ; $P = 0.02$).

Conclusions Patients exhibited reduced function seven days following ambulatory surgery. Patient function largely recovered by POD 30. Caregiver burden was variable and influenced by both patient and caregiver function. This trial was registered with ClinicalTrials.gov (NCT01382251).

Résumé

Objectif L'objectif principal de cette étude de cohorte prospective était d'évaluer l'impact d'une chirurgie ambulatoire sur le fonctionnement de patients une semaine et un mois après la chirurgie chez des patients de 65 ans ou plus ayant subi une chirurgie. Les objectifs secondaires étaient de déterminer si des changements au

niveau du fonctionnement étaient corrélés à un fardeau de soins accru pour l'aidant le plus proche et aux évaluations par les patients de leur douleur postopératoire et de leur qualité de vie.

Méthode Après avoir obtenu le consentement du Comité d'éthique de la recherche, des patients âgés ≥ 65 ans subissant une chirurgie ambulatoire non urgente et leurs aidants ont été recrutés. Les patients ont rempli les questionnaires suivants: le Système de mesure de l'autonomie fonctionnelle (SMAF) et l'Inventaire abrégé de la douleur. Les proches aidants ont complété l'Échelle de fardeau de Zarit (ZBI). Toutes les mesures ont été obtenues avant l'opération et aux jours postopératoires (JPO) 7 et 30.

Résultats Le fonctionnement des patients était réduit au JPO 7 et n'avait pas atteint à nouveau les valeurs de base au JPO 30 (changement moyen sur l'échelle SMAF 6,9; intervalle de confiance (IC) 95 % 5,3 à 8,4 au JPO 7 et changement moyen sur le SMAF 2,6; IC 95 % 1,3 à 4,0 au JPO 30). Au JPO 30, les changements d'intervalle dans le fardeau des aidants n'étaient pas significatifs (changement moyen selon le ZBI $-0,4$; IC 95 % $-1,8$ à $0,96$ au JPO 7 et changement selon le ZBI $-0,6$; IC 95 % $-2,1$ à $0,8$ au JPO 30). La réduction de fonctionnement des patients était associée à un fardeau accru pour l'aidant à tous les points dans le temps ($P < 0,001$). La réduction du fonctionnement de l'aidant lors des mesures de base était également associée à un ZBI plus élevé (association linéaire $0,71$; $P = 0,02$).

Conclusion Les patients ont montré un fonctionnement réduit sept jours après une chirurgie ambulatoire. Le fonctionnement des patients était pratiquement rétabli au JPO 30. Le fardeau des aidants était variable et influencé tant par le fonctionnement du patient que par celui de l'aidant. Cette étude a été enregistrée auprès de Clinical Trials.gov (NCT01382251).

Like many Western societies, the Canadian population is aging. The 2006 national census indicated that 14% of Canadians were 65 yr of age or older, and data from the Canadian Institute for Health Information suggest that this group consumes 44% of health expenditures.¹ This disproportionate use of health resources was also reflected in the 2006 National Survey of Ambulatory Surgery which documented that one-third of all ambulatory surgeries were performed on patients over the age of 65.² Despite the predominance of older patients in the outpatient setting, the focus of previous research on the functional sequelae of ambulatory surgery has been on much younger patients.^{3,4} Shifting demographics and improvements in anesthetic and surgical care will produce a “boom” in outpatient surgery

among the elderly. To promote safe ambulatory surgery among older patients, we must better understand the needs of this heterogeneous population.

Previous research indicates that ambulatory surgery has a significant impact on postoperative function and that this impact is greater than anticipated by patients or their health care providers. These findings prompted one author to conclude that “although the provider ‘cost’ may have been reduced with the transition to ambulatory surgery, a significant portion of the cost or impact of this care may have been merely shifted to the patient and family.”³

“Caregiver burden” refers to the physical, emotional, social, and financial costs incurred by the caregiver. Among patients and families recovering from major surgery, it has been noted that “family caregivers had similar quality of life disruptions as patients in overall physical, social, spiritual, and total quality of life scores.”⁵ Surgeries once offered as inpatient stays are increasingly being performed on an outpatient basis; this trend, when combined with an aging surgical population, predicts a significant impact on the caregivers bearing the responsibility for postoperative care.

The primary objective of this study was to assess the impact of ambulatory surgery on patient function one week and one month following surgery in a population of surgical patients 65 years of age or older. Secondary objectives were to determine whether changes in patient functional capacity were correlated with postoperative pain, increased burden of care to the patient's primary caregiver, and the quality of life of both patient and caregiver.

Methods

Following The Ottawa Hospital Research Ethics Board Approval (Protocol Number 2009390, approved October 29, 2009), patients scheduled to undergo elective ambulatory orthopedic (hip, knee, and shoulder arthroscopy, foot surgery, lumbar discectomy) or peritoneal (inguinal or ventral herniorrhaphy, laparoscopic biliary or gynecological surgery, genitourinary repair) surgeries were assessed for eligibility for this prospective observational cohort study. We chose these populations as being both characteristic of ambulatory surgery and of sufficient physiological trespass to present a threat to patient function. All surgeries were performed at The Ottawa Hospital, a 900-bed tertiary care university-affiliated hospital spanning three geographically distinct campuses that include a free-standing ambulatory surgical centre. Eligible surgeries were booked with an anticipated length of hospital stay of 23 hr or less. Eligible criteria included patients 65 yr of age or older who identified

a partner or adult descendant as their primary caregiver. Patients were excluded if they resided in a nursing home or received professional support services; similarly, caregivers hired to assist the patient were excluded. Both patients and caregivers were excluded if they were unable to complete the study instruments due to cognitive or physical impairment or if they were unable to speak English or French. Patient-caregiver dyads scheduled for qualifying surgeries were approached by a research assistant in the pre-admission units and assessed for study eligibility. Participation was restricted to those dyads in which both the patient and caregiver provided written informed consent. Screening began on July 1, 2010, and the final assessment was completed on January 4, 2012.

The following basic information was recorded from consenting patients and caregivers at baseline: age, sex, employment status, household income, functional capacity as assessed by *système de mesure de l'autonomie fonctionnelle* (SMAF), quality of life as assessed by the Short Form 12 version 2 (SF-2), and cognitive function as assessed by the Mini-Mental State Examination (MMSE). Results from the surgical patients' baseline Brief Pain Inventory (BPI) and numeric rating scale (NRS) for pain were also recorded. Caregiver burden was assessed using the Zarit Burden Interview (ZBI).

The SMAF is a 29-item scale that reflects the World Health Organization classification of disabilities.⁶ It assesses both basic (personal hygiene, self-feeding, ambulation in home, etc) and instrumental (housework, taking medications, meal preparation, shopping, etc) activities of daily living (ADLs). Each item is graded on a four-point scale (0 = independent; 1 = needs supervision or stimulation; 2 = needs help; 3 = dependent). Scores range from 0 to 87 with higher scores indicating increased disability. Typical SMAF scores of community-dwelling elders are 10 (standard deviation [SD] 9), while those admitted to a nursing home score 29 (interquartile range [IQR] 21-37).⁷ The minimal clinically important difference in SMAF is five points.⁸

The BPI assesses pain using an 11-point NRS; it also includes a functional interference index comprised of seven questions in which the subject is asked to describe the extent to which pain interferes with activity. Scores are anchored at 0 for "does not interfere" and 10 for "completely interferes". The seven resulting scores are averaged and reported as a single value with higher scores indicating greater interference with function.

The Zarit Burden Interview (ZBI)⁹ is a 22-item questionnaire in which subjects rate how often they experience negative feelings associated with the care they provide on a scale from 0 (never) to 4 (nearly always). Scores range from 0-88 with higher scores indicating increased burden of care. Mean (SD) ZBI scores of 20.4

(13) and 23.2 (13) were reported among those caring for patients with chronic obstructive lung disease¹⁰ and cancer,¹¹ respectively (Mapi Research Trust, Lyon, France. Internet: www.mapi-trust.org).

The SF-12 is a well-validated measure of health-related quality of life comprised of 12 questions regarding the respondent's experience over the preceding week. The SF-12 is a scale comprised of 12 questions (Likert items) that generate Physical and Mental Component Scores ranging from 0-100 with higher scores indicating better quality of life.

Patients enrolled in this study received the usual perioperative care. Monitoring, anesthetic technique, and postoperative analgesia were at the discretion of the attending anesthesiologist. Duration of hospital stay, unplanned admissions to hospital, type of anesthesia, and any adverse events, including unplanned admission to hospital, were recorded.

On postoperative days (POD) 7 and 30, patients and caregivers were contacted by telephone for postoperative follow-up by trained assistants. Whenever possible, both patient and caregiver were interviewed separately by the same evaluator. On both POD 7 and POD 30, the patients repeated the SMAF, SF-12, and BPI questionnaires, and the caregivers completed the SF-12 and ZBI. A period of two days on either side of POD 7 and POD 30 was allowed if it was not possible to contact the patient or caregiver on the exact date. The patients completed a daily diary to document NRS for pain at rest and with activity on POD 1 through 5. Both patients and caregivers were given the opportunity to describe their experience using free text comments, and they returned the completed diaries using an addressed stamped envelope.

Sample size was estimated around the changes in SMAF and ZBI scores using a confidence interval estimation approach. As mentioned earlier, the average (SD) SMAF change score in a cohort of community-dwelling Canadian elders was reported as 10.0 (9). Based on a desired precision (margin of error) of ± 2.5 points for a two-sided 95% confidence interval estimate around the mean change, a sample size of 50 patients is required. A literature search revealed no usable estimates for the mean and standard deviation of ZBI change scores for caregivers of community-dwelling elders undergoing ambulatory surgery; however, the ZBI is frequently used in dementia studies. Results of the Canadian Outcomes Study in Dementia involving 766 patients from 31 Canadian sites revealed a mean (SD) score for caregivers of 24.9 (14.5).¹² In contrast, a study of 152 primary caregivers of community-dwelling older adults with dementia in France yielded a mean (SD) ZBI score of 32.9 (17.9).¹³ For the purpose of sample size calculation, we assumed the more conservative estimate (SD = 17.9). A sample size of 50 patients would yield a satisfactory precision (margin of error) of $\pm$ five

points for a two-sided 95% confidence interval estimate around the mean change. We were uncertain whether the orthopedic and peritoneal surgeries would differ in terms of physical disability or caregiver burden so the study was powered for separate provision of the desired precision in each of the two surgical subgroups. A pooled analysis of all patients and caregivers was planned if subgroup differences were absent. As a result, our total sample size estimate was 100 patient-caregiver dyads: 50 in the abdominal group and 50 in the orthopedic group. To accommodate 15% attrition, we planned to enrol 120 patients.

Descriptive statistics (mean and standard deviation for continuous variables, and frequency and percentage for categorical variables) were calculated to summarize baseline demographic data on patients and caregivers. In the case of substantial skewness for continuous variables, medians and interquartile ranges were calculated. Characteristics were compared between the two subgroups at each measurement time using Pearson's Chi square, Wilcoxon rank sum, and unpaired Student's *t* tests to assess similarity of the abdominal and orthopedic subgroups.

The impact of ambulatory surgery on patients' functional capacity (SMAF) was analyzed using a longitudinal linear regression model.¹⁴ Time was included as a categorical variable (baseline, POD 7, POD 30), and an unstructured covariance matrix was employed to account for within-subject correlations. Parameter estimates were obtained using the restricted maximum likelihood method. Mean changes from baseline in patients' SMAF scores were determined from the regression model. To maintain a family-wise error rate of 5% over the two comparisons (POD 7 and POD 30) to baseline, confidence intervals and *P* values were adjusted using Dunnett's method. All *P* values are two-sided. Similar approaches were used to evaluate changes in other secondary outcomes (SF-12 and BPI).

The impact of ambulatory surgery on patients' primary caregivers (ZBI scores) was analyzed using a longitudinal linear regression model as described for the primary analysis above.

To evaluate the longitudinal association between caregiver burden and patients' functional capacity, longitudinal linear regression analysis was conducted as described above with repeated measures of the ZBI score as a dependent variable and independent variables: categorical time (baseline, POD 7, POD 30), patient SMAF as a time-varying predictor, interaction between patient SMAF and time, caregiver SMAF at baseline, as well as patient age and type of surgery. To improve parameterization of the models, continuous predictors were centred about their medians prior to analysis. The functional form of the associations with continuous predictors was assessed by visual inspection of scatterplots with an overlaid nonparametric locally

weighted smoothing fit. SAS® version 9.2 (SAS Institute, Inc., Cary, NC, USA) was used for all analyses.

This trial is reported in accordance with the STrengthening the Reporting of OBservational studies in Epidemiology (STROBE) guidelines.¹⁵

Results

Participant accrual and retention

Participant recruitment, enrolment, and progress throughout the study are illustrated in Fig. 1. Of 380 patient-caregiver dyads screened, 281 met the eligibility criteria and 123 (44%) consented to participate. Surgery was cancelled in 16 cases and 5 dyads were lost to follow-up, leaving 102 dyads with complete information on the primary outcome measures.

Participant characteristics

Participant demographics and baseline characteristics are presented in Table 1. Patients and caregivers were of a similar age; 86% of caregivers were partnered to the patient and 25% were employed at the time of surgery. Four patients (4%) experienced an unplanned admission to hospital following surgery. Indications for admission in the

Fig. 1 Participant accrual and retention

Table 1 Participant characteristics and outcomes

	Orthopedic (<i>n</i> = 51)	Peritoneal (<i>n</i> = 51)	All Patients (<i>n</i> = 102)	Caregivers (<i>n</i> = 102)
Mean age (SD)	70 (4.5)	73 (6.5)	71 (6.0)	67 (11)
Male sex (%)	19 (37)	29 (57)	48 (47)	47 (47)
ASA Physical Status (I, II, III, IV)	(1, 28, 19, 3)	(2, 28, 20, 1)	(3, 56, 39, 4)	-
Median MMSE (25 th , 75 th centile)	29 (28, 30)	29 (29, 30)	29 (29, 30)	-
Any employment (%)	11 (22)	3 (6)	14 (14)	25 (25)
Caregiver is partner (%)				86 (86%)
Unplanned admission (%)	3 (4)	1 (4)	4 (4)	-
Mean SMAF (SD)				
Baseline	4.6 (7.4)	3.4 (4.0)	4.0 (5.9)	2.0 (2.9)
POD 7	11.3 (7.0)	10.5 (8.2)	10.9 (7.6)	-
POD 30	7.4 (7.2)	7.4 (7.3)	6.7 (7.2)	-
Mean Caregiver ZBI (SD)				
Baseline	9.2 (10.0)	9.2 (9.7)	9.3 (9.9)	
POD 7	9.4 (10.8)	8.3 (8.7)	8.9 (9.8)	
POD 30	9.1 (10.0)	7.9 (10.1)	8.6 (10.6)	

ASA = American Society of Anesthesiologists; MMSE = Mini-Mental State Examination; SMAF = système de mesure de l'autonomie fonctionnelle; ZBI = Zarit Burden Interview; POD = postoperative day; SD = standard deviation

orthopedic subgroup included uncontrolled pain, myocardial infarction, and a transient ischemic attack several days following discharge. A small bowel perforation and subsequent resection prompted a three-week admission in the peritoneal surgery subgroup. There were no deaths in the 30 days following surgery.

Functional recovery

Mean (SD) SMAF scores at baseline, POD 7, and POD 30 are shown in Table 1. A line graph displaying individual patient SMAF scores over time is presented in Fig. 2. There were no statistically significant differences between the orthopedic and peritoneal subgroups at any time (Wilcoxon Rank Sum test $P = 0.85, 0.47, 0.23$ for baseline, POD 7, and POD 30 scores, respectively); observed differences were small and not clinically significant. Subsequent analysis of functional recovery will consider all patient participants as a single group.

Least-square mean increases in SMAF were 6.9 (95% CI 5.3 to 8.4; $P < 0.001$) and 2.6 (95% CI 1.3 to 4.0; $P < 0.001$) from baseline to POD 7 and POD 30, respectively. Only two patient participants (2%) recorded SMAF scores consistent with nursing home placement at POD 7 and POD 30.

The SMAF score may also be used to calculate minutes of skilled nursing time required for a patient of a given degree of disability.⁷ Using this function, we estimate that patients in this cohort would require a median [IQR] of 23.5 [17–31] min of daily nursing care seven days following ambulatory surgery.

Pain and function

There were no statistically significant differences in BPI functional interference scores or peak NRS pain scores between orthopedic and peritoneal subgroups at any time point (results not shown). Summary BPI functional interference and peak NRS scores for all patients are shown in Table 2. A small reduction in BPI functional interference scores for all subjects was evident at POD 30, but the magnitude of this change was of questionable clinical significance. In the longitudinal regression analysis of the association between SMAF and BPI, time and BPI were statistically significant, but the interaction between BPI and time was not. This suggests that the association between BPI and SMAF did not vary over time. The linear association between SMAF and BPI was 0.67 (95% CI 0.37 to 0.98; $P < 0.001$), indicating that a 1-unit increase in BPI was associated with a 0.67 unit increase in SMAF.

Caregiver burden

Mean (SD) ZBI scores at baseline, POD 7, and POD 30 are shown in Table 1. There were no statistically significant differences between orthopedic and peritoneal subgroups at any time (Wilcoxon Rank Sum test $P = 0.45, 0.66, 0.61$ for baseline, POD 7, and POD 30 scores, respectively); observed differences were small and not clinically significant. Subsequent analysis of caregiver burden will consider all caregiver participants as a single group. A line graph displaying individual caregiver ZBI scores over time is presented in Fig. 3. Mean caregiver burden did not

Fig. 2 Système de Mesure de l'Autonomie Fonctionnelle (SMAF). Explanation: The SMAF reflects both basic and instrumental activities of daily living with higher scores associated with increasing disability. Individual patient scores are represented by

dots at baseline and postoperative days 7 and 30. Trend lines join the scores for each individual patient. A median trend line in bold font is provided as a summary measure of changes in patient function over time

Table 2 Pain rating scores

	Orthopedic	Peritoneal	Total	Change (95% CI)
BPI - Function	(<i>n</i> = 51)	(<i>n</i> = 51)	(<i>n</i> = 102)	(<i>n</i> = 102)
Baseline	2.4 (2.6)	1.3 (2.1)	1.8 (2.4)	Reference
POD 7	2.1 (2.1)	2.0 (2.1)	2.1 (2.1)	0.24 (−0.24 to 0.72)
POD 30	1.6 (1.9)	0.7 (1.4)	1.2 (1.7)	−0.66 (−1.12 to −0.21)
NRS Pain	(<i>n</i> = 46)	(<i>n</i> = 46)	(<i>n</i> = 92)	
POD 1	4.6 (3.0)	5.2 (2.5)	4.9 (2.8)	
POD 2	4.5 (3.1)	5.1 (2.5)	4.8 (2.8)	
POD 3	3.7 (2.6)	4.3 (2.8)	4.0 (2.8)	

BPI-Function = Brief pain inventory functional interference score

NRS = numeric rating scales, POD = postoperative day

All data expressed as mean (standard deviation). Differences between subgroups were not statistically significant at any time point (results not shown)

Least-square mean changes are calculated from baseline and expressed with multiplicity adjusted 95% confidence intervals. NRS assessments of worst pain are presented for descriptive purposes only

increase over the study interval: least-square mean changes in ZBI scores were -0.4 (95% CI -1.8 to 1.0 ; $P = 0.75$) and -0.6 (95% CI -2.1 to 0.9 ; $P = 0.57$) from baseline to POD 7 and POD 30, respectively. Nevertheless, caregiver experience was highly variable with eight caregivers (8%) reporting degrees of caregiver burden at baseline that were consistent with caring for a patient with cancer.¹⁰ A similar number, but not the same individual caregivers, revealed these clinically significant levels of burden at POD 30.

Predictors of caregiver burden

The results of the analyses of longitudinal association between caregiver burden and patients' functional capacity are shown in Table 3. Patient function (as assessed by the SMAF) was positively associated with ZBI, suggesting that patients with poor function were a burden to their caregivers. The interaction between patient function and time was statistically significant, suggesting that the association between caregiver burden and patient function varied over time. In particular, a 1-unit

Fig. 3 Zarit Burden Interview (ZBI). Explanation: The ZBI reflects caregiver burden with higher scores associated with increased burden of care. Individual caregiver scores are represented by dots at baseline

and postoperative days 7 and 30. Trend lines join the scores for each individual caregiver. A median trend line in bold font is provided as a summary measure of changes in caregiver burden over time

increase in a patient's SMAF score was associated with 0.20, 0.13, and 0.51 unit increases in caregiver burden at baseline, POD 7, and POD 30, respectively. This analysis confirmed that ZBI scores showed no statistically significant trends across the study interval. Interestingly, caregiver SMAF was also a statistically significant predictor of caregiver burden (ZBI) indicating that less physically capable caregivers reported greater stress in providing care for their loved ones (linear association 0.71; 95% CI 0.13 to 1.29; $P = 0.02$). Patient age ($P = 0.76$) and surgery type ($P = 0.83$) were reviewed as potential predictors but were non-significant and were excluded from the regression model for simplicity.

Quality of life

Mental and physical component scores of the SF-12 for both patient and caregivers across the study interval are shown in Table 4. Least-square mean changes are calculated from baseline and expressed with multiplicity adjusted 95% confidence intervals. Patient's physical, but not mental, component scores were decreased at POD 7. Both physical and mental components had returned to baseline values by POD 30. Observed changes in both physical and mental component scores of caregivers were neither clinically nor statistically significant.

Discussion

Our findings showed that ambulatory surgery resulted in a measurable decline in patient function lasting up to seven

days among our population of elderly outpatients. While SMAF scores for the group as a whole remained consistent with community-dwelling elders, the change in SMAF following surgery surpassed the minimal clinically important difference for this measure. The increasing BPI functional interference score was positively associated with disability, suggesting that poor postoperative pain control contributed to decrements in patient function. Mean caregiver burden scores did not vary over the 30-day study interval; however, perceived burden of care among primary caregivers of older surgical outpatients was highly variable. The majority of outpatients in our study regained their baseline function within 30 days of ambulatory surgery, but degree of disability in both patient and caregiver were significant predictors of caregiver burden.

The changes in SMAF and the physical component of the SF-12 are consistent with a number of previously published reports documenting persistent pain and disability following ambulatory surgery. Approximately 40% of patients reported pain and mobility problems seven days following surgery in an observational cohort of 355 patients undergoing inguinal herniorrhaphy, arthroscopy, and breast surgery.¹⁶ Similarly, both basic and instrumental ADLs were significantly impaired on discharge and four days following hernia repair and laparoscopy in a cohort of outpatients aged 18–64.³ It is important to point out that the decline in SMAF scores reported in the present study was found in a population with relatively low levels of preoperative disability. Health care providers may not anticipate or prepare patients and families to expect disability in these relatively fit patients.

Table 3 Longitudinal analysis of the association between caregiver burden (ZBI) and patient function (SMAF), accounting for caregiver function (SMAF) at baseline

Effect	Estimated regression coefficient	95% confidence interval	P value
Intercept	8.05	5.83 to 10.28	<.001
Caregiver SMAF at baseline*	0.71	0.13 to 1.29	0.02
Time [#]			0.14
POD 0	Reference category		
POD 7	−1.37	−3.10 to 0.36	
POD 30	−1.45	−2.91 to 0.01	
SMAF (patient)**	0.20	−0.02 to 0.42	<0.001
SMAF (patient) x time ^{&}			<0.001
POD 0	Reference category		
POD 7	−0.07	−0.32 to 0.17	
POD 30	0.30	0.06 to 0.54	

Since continuous covariates were centred about their median values, the intercept represents the estimated mean baseline ZBI score for a caregiver with “average” functional capacity caring for an “average” patient

* Estimated association between caregiver SMAF and caregiver burden at baseline. (A 1-unit increase in caregiver SMAF is associated with an increase of 0.71 in caregiver burden.)

** Estimated association between patient SMAF and caregiver burden at baseline. (A 1-unit increase in patient SMAF is associated with a 0.20 increase in caregiver burden.)

[#] Estimated change in mean caregiver burden from baseline

[&] Estimated change in the association between patient SMAF and caregiver burden at POD 7 and POD 30. (For example, the linear association at baseline is 0.2; the linear association at POD 7 is $0.2 - 0.07 = 0.13$; the linear association at POD 30 is $0.2 + 0.3 = 0.5$.)
POD = postoperative day; SMAF = système de mesure de l'autonomie fonctionnelle; ZBI = Zarit Burden Interview

Table 4 Quality of life: Short form 12 mental and physical component scores

	Patient <i>n</i> = 102	Change (95% CI)	Caregiver <i>n</i> = 102	Change (95% CI)
Mental CS				
Baseline	55.3 (7.5)	Reference	55.9 (6.6)	Reference
POD 7	54.9 (8.8)	−0.4 (−2.0 to 1.2)	54.4 (9.0)	−1.5 (−3.3 to 0.3)
POD 30	56.2 (7.8)	0.9 (−1.0 to 2.8)	54.8 (8.0)	−1.1 (−2.7 to 0.5)
Physical CS				
Baseline	43.4 (12.7)	Reference	50.5 (7.9)	Reference
POD 7	35.1 (10.3)	−8.3 (−10.9 to −5.6)	51.2 (8.4)	0.7 (−0.6 to 2.0)
POD 30	42.7 (11.4)	−0.7 (−3.3 to 1.9)	51.3 (8.9)	0.9 (−0.3 to 2.0)

CS = component score; POD = postoperative day

Results expressed as mean (standard deviation). Least-square mean changes are calculated from baseline and expressed with multiplicity adjusted 95% confidence intervals

The association between postoperative analgesia and patient function has been described previously. Findings from a cohort study of 93 patients aged 17–59 undergoing arthroscopy, laparoscopy, and carpal tunnel release indicated that 44% of patients reported that pain limited function in three or more ADLs seven days after surgery; 26% indicated that they experienced more pain than they had anticipated.⁴ Similarly, our results indicated that there was a positive association between pain and disability. These findings suggest that enhanced postoperative

analgesia regimens may make for a more comfortable and a more functional convalescence.

The impact of major cardiac¹⁷ and oncological⁵ surgery on caregivers is well described. It is noteworthy that even brief contacts with the health care system impact friends and family of the patient.¹⁸ Our results indicate that caregiver burden before and after ambulatory surgery was highly variable and that 10% of caregivers reported levels of burden consistent with major illness.¹¹ The finding of high preoperative levels of caregiver burden was

unexpected. It is unclear whether preoperative burden reflected the surgical problem, the underlying patient medical condition, or simply the inconvenience of multiple medical appointments faced when preparing for surgery. Both patient and caregiver function were important predictors of caregiver burden. These findings echo those of the Canadian Patient Safety Institute who maintain that “issues for client, family, caregiver, and provider are interconnected, interrelated, and influenced by one another” throughout an evaluation of the safety of home-based care,¹⁹ and they suggest that the abilities of both parties in the patient-caregiver dyad be considered during preoperative evaluation.

Our study has several limitations. The primary objective of our study was to describe the experience of a fast-growing but overlooked group of outpatients, i.e., the elderly. Our primary focus was to shed light on the challenges faced by older outpatients and their caregivers who, despite their prevalence in outpatient surgical programs, have been underrepresented in previous research.^{3,4} In an attempt to minimize the burden of questionnaires on our participants, we selected POD 7 for our first postoperative assessment of function, a time consistent with previous studies and an expectation of return to relatively normal postoperative function. The fact that measurable disability persisted at a time when most stakeholders believe that the patient would be back to normal highlights the impact of relatively minor surgery on the older patient. Similarly, it is possible that we underestimated the impact of care on the primary caregiver by restricting our first assessments of caregiver burden to POD 7. Total burden may have been further discounted by limiting assessment to the primary caregiver and excluding other family members and friends who contributed to the patient’s postoperative care. Even so, 84% of caregivers identified themselves as the patient’s partner and undertook the majority of care without additional community or familial support. It should be pointed out that key outcome measurements were obtained at only one other time, i.e., POD 30. This sparse coverage of the 30-day postoperative period limits our ability to estimate the interval of maximum or minimum functional impairment and associations between variables over time. For this reason, we modelled time as a categorical variable so no functional form was imposed on the association with time. One might be concerned that the test scores of the four patients who were admitted or readmitted to hospital for complications would be atypical and skew our results. It is of interest that only one of the four patients in question scored worse than the group mean on our measure of function. For the most part, caregivers of these individuals reported burden scores greater than the group mean, but our group results did not indicate a systematic increase in burden following surgery. Finally, our results represent a single centre’s experience

with a population where non-working partners provided the majority of care. Extrapolation of our findings to other surgeries, communities, or family relationships must be made with caution.

In conclusion, this prospective observational cohort study provides valuable insights into the experiences of the older outpatient and their caregiver following ambulatory surgery. Functional recovery is delayed for a minimum of a week, and this delay may be influenced by the quality of postoperative analgesia. While postoperative changes in patient function did not drive caregiver burden, we found that the degree of patient and caregiver disability was associated with increased burden of care. This finding highlights the importance of assessing both the patient and their discharge environment when determining fitness for increasingly invasive outpatient care. Outpatient services will be under both budgetary and demographic pressures in the years ahead. Detailed understanding of the determinants of successful ambulatory surgical programs for the aging surgical patient should be the focus of both clinicians and researchers.

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Conflicts of interest None declared.

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