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Patient Satisfaction, Chronic Pain, and Functional Status following Laparoscopic Ventral Hernia Repair

Mike K. Liang · Marissa Clapp · Linda T. Li · Rachel L. Berger · Stephanie C. Hicks · Samir Awad

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Abstract

Background Ventral hernia repairs are one of the most common surgeries performed. Symptoms are the most common motivation for repair. Unfortunately, outcomes of repair are typically measured in recurrence and infection rather than patient focused results. We correlated factors associated with decreased patient satisfaction, chronic pain, and diminished functional status following laparoscopic ventral hernia repair (LVHR)

Methods A retrospective study of 201 patients from two affiliated institutions was performed. Patient satisfaction, chronic abdominal pain, pain scores, and Activities Assessment Scale results were obtained in 122 patients. Results were compared with univariate and multivariate analysis.

Results Thirty-two (25.4 %) patients were dissatisfied with their LVHR while 21 (17.2 %) patients had chronic abdominal pain and 32 (26.2 %) patients had poor functional status following LVHR. Decreased patient satisfaction was associated with perception of poor cosmetic outcome (OR 17.3), eventration (OR 10.2), and chronic pain (OR 1.4). Chronic abdominal pain following LVHR was associated with incisional hernia (OR 9.0), recurrence (OR 4.3), eventration (OR 6.0), mesh type (OR 1.9), or ethnicity (OR 0.10). Decreased functional status with LVHR was associated with mesh type used (OR 3.7), alcohol abuse (OR 3.4), chronic abdominal pain (OR 1.3), and age (OR 1.1).

Conclusions One-fourth of patients have poor quality outcome following LVHR. These outcomes are affected by perception of cosmesis, eventration, chronic pain, hernia type, recurrence, mesh type, and patient characteristics/co-morbidities. Closing central defects and judicious mesh selection may improve patient satisfaction and function. Focus on patient-centered outcomes is warranted.

Introduction

Ventral hernia repairs are one of the most common procedures performed by general surgeons [1]. The main motivation for hernia repair revolves around symptoms such as pain, discomfort, and decreased ability to function normally [2–5]. While risk of incarceration and strangulation is also a concern, the likelihood of these complications is modest in comparison to physical symptoms [2–5]. For other types of hernias (such as inguinal or hiatal hernias), symptoms are the main reason for repair, and patients with few or no symptoms can consider conservative treatment or watchful waiting [6].

Despite the fact that quality of life is the main motivation for hernia repair, surgeons tend to measure success in terms of clinical outcomes such as surgical site infection, hernia recurrence, and seroma formation [7–22]. Quality of life measures, including patient satisfaction, chronic pain, and functional status, are seldom measured or reported [23–30]. The purposes of the present study were to evaluate patient satisfaction, chronic pain, and functional status following laparoscopic ventral hernia repair and to patient factors that affect quality of life.

M. K. Liang (✉) · M. Clapp · L. T. Li · R. L. Berger · S. Awad
Michael E. DeBakey Department of Surgery, Baylor College of Medicine, Michael E. DeBakey VA Medical Center, 2002 Holcombe Blvd, OCL (112), Houston, TX 77030, USA
e-mail: ml3@bcm.edu

S. C. Hicks
Department of Statistics, Rice University, P.O. Box 1892, Houston, TX 77251-1892, USA

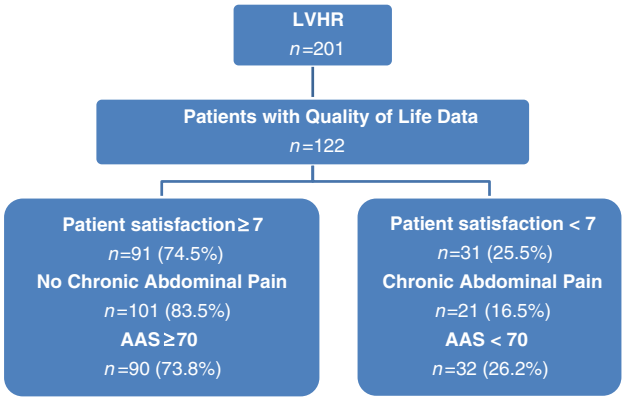

Fig. 1 Follow-up on 201 patients undergoing laparoscopic ventral hernia repair

Table 1 Patient satisfaction

	Patient satisfaction ≥7 ($n = 91$)	Patient satisfaction <7 ($n = 31$)	p value
Demographics			
Age	56 ± 1.2	58 ± 1.5	0.40
Gender			0.01
M	67 (73.6 %)	29 (93.4 %)	
F	24 (26.4 %)	2 (6.5 %)	
Ethnicity			0.31
Caucasian	75 (82.4 %)	23 (74.2 %)	
Black	16 (17.6 %)	8 (25.8 %)	
Co-morbidities			
ASA			0.30
4	3 (3.3 %)	0 (0 %)	
3	54 (59.3 %)	24 (77.4 %)	
2	29 (31.9 %)	6 (19.4 %)	
1	5 (5.5 %)	1 (3.2 %)	
BMI	33 ± 0.75	32 ± 0.74	0.49
Coronary artery disease	25 (27.5 %)	8 (25.8 %)	1.00
COPD	12 (13.2 %)	5 (16.1 %)	0.77
Prostate disease	13 (14.3 %)	9 (29.0 %)	0.10
Diabetes mellitus	29 (31.9 %)	8 (25.8 %)	0.65
Smoking	27 (29.7 %)	10 (32.3 %)	0.82
Alcohol abuse	12 (13.2 %)	6 (19.4 %)	0.37
Hernia data			
Grade			0.94
4	0 (0 %)	0 (0 %)	
3	14 (15.4 %)	4 (12.9 %)	
2	66 (72.5 %)	23 (74.2 %)	
1	11 (12.1 %)	4 (12.9 %)	
Hernia width	4.1 ± 0.30	4.8 ± 0.68	0.26
Hernia length	5.9 ± 0.56	6.4 ± 0.94	0.63
Hernia area	25.6 ± 4.2	34.6 ± 9.7	0.33
Secondary hernia	50 (54.9 %)	23 (74.2 %)	0.09
Primary hernia	41 (45.1 %)	8 (25.8 %)	
Recurrent hernia	22 (24.2 %)	8 (25.8 %)	1.00
Number prior abdominal surgeries	1.3 ± 0.13	1.1 ± 0.19	0.58
Operative data			
Surgeon (1–7)[a]			0.15
Mesh type			0.01
Polypropylene	62 (68.1 %)	25 (80.6 %)	
Polyester	20 (22.0 %)	0 (0 %)	
Polytetrafluoroethylene	9 (9.9 %)	6 (19.4 %)	
Permanent sutures	81 (89.0 %)	21 (67.7 %)	0.01
TCCD	29 (31.9 %)	3 (9.7 %)	0.02
Early outcomes (≤30 days)			
Surgical site infection	7 (7.7 %)	8 (25.8 %)	0.02
Pneumonia	4 (4.4 %)	1 (3.2 %)	1.00
Urinary tract infection	3 (3.3 %)	4 (12.9 %)	0.07
All infections	8 (8.8 %)	12 (38.7 %)	0.004
Ileus	4 (4.4 %)	4 (12.9 %)	0.11
Urinary retention	7 (7.7 %)	6 (19.4 %)	0.09
Seromas	14 (15.4 %)	9 (29.0 %)	0.11
All complications	35 (38.5 %)	20 (64.5 %)	0.02
Length of stay	2.0 ± 0.35	2.8 ± 0.68	0.30
Readmission	0 (0 %)	4 (12.9 %)	0.004
Late outcomes (>30 days)			
Recurrence	6 (6.6 %)	12 (38.7 %)	0.0001
Eventration	35 (38.5 %)	27 (87.1 %)	0.0001
Bowel obstruction	2 (2.2 %)	1 (3.2 %)	1.00
Reoperation	4 (4.4 %)	4 (12.9 %)	0.11
Cosmetic satisfaction	8.9 ± 0.19	4.9 ± 0.56	0.0001
Worst pain	1.9 ± 0.28	5.8 ± 0.59	0.0001
Chronic pain	8 (8.8 %)	13 (41.9 %)	0.0001
AAS	77.5 ± 1.2	66.4 ± 1.9	0.0001
Follow-up	24 (6–133)	24 (6–134)	0.30

[a] Attending surgeon assigned as surgeon 1–7

Methods

The study was a retrospective cohort study of all patients (consecutive) who underwent a laparoscopic ventral hernia repair at a two affiliated hospitals from 2000 to 2010. All patients who completed a successful laparoscopic ventral hernia repair were included in the study. Institutional Review Board approval was obtained at both participating institutions.

Table 2 Chronic pain

	No chronic pain ($n = 101$)	Chronic pain ($n = 21$)	p value
Demographics			
Age	57 ± 1.1	54 ± 1.9	0.14
Gender			0.39
M	81 (80.2 %)	15 (71.4 %)	
F	20 (19.8 %)	6 (28.6 %)	
Ethnicity			0.03
Caucasian	82 (81.1 %)	14 (66.7 %)	
Black	16 (15.8 %)	7 (33.3 %)	
Co-morbidities			
ASA			0.82
4	2 (2.0 %)	1 (4.8 %)	
3	66 (65.3 %)	12 (57.1 %)	
2	28 (27.7 %)	7 (33.3 %)	
1	5 (5.0 %)	1 (4.8 %)	
BMI	33 ± 0.67	32 ± 1.2	0.68
Coronary artery disease	29 (28.7 %)	4 (19.0 %)	0.42
COPD	16 (15.8 %)	1(4.8 %)	0.30
Prostate disease	19 (18.8 %)	3 (14.3 %)	0.76
Diabetes mellitus	30 (29.7 %)	6 (28.6 %)	1.00
Smoking	29 (28.7 %)	8 (38.1 %)	0.44
Alcohol abuse	14 (13.9 %)	4 (19.0 %)	0.51
Hernia data			
Grade			0.42
4	0 (0 %)	0 (0 %)	
3	13 (12.9 %)	5 (23.8 %)	
2	75 (74.3 %)	14 (66.7 %)	
1	13 (12.9 %)	2 (9.5 %)	
Hernia width	3.8 ± 0.26	6.2 ± 0.87	0.0009
Hernia length	5.5 ± 0.54	7.8 ± 1.00	0.058
Hernia area	23.4 ± 3.9	46.6 ± 11.9	0.02
Secondary hernia	56 (55.4 %)	17 (81.0 %)	0.048
Primary hernia	45 44.6 %)	4 (19.0 %)	
Recurrent hernia	22 (21.8 %)	8 (38.1 %)	0.16
Number prior abdominal surgeries	1.2 ± 0.12	1.5 ± 0.25	0.29
Operative data			
Surgeon[a]			0.28
Mesh type			0.005
Polypropelene	76 (75.2 %)	11 (52.4 %)	
Polyester	17 (16.8 %)	3 (14.3 %)	
Polytetrafluoroethylene	8 (7.9 %)	7 (33.3 %)	
Permanent sutures	88 (87.1 %)	14 (66.7 %)	0.045
TCCD	29 (28.7 %)	3 (14.3 %)	0.43
Early outcomes (≤30 days)			
Surgical site infection	10 (9.9 %)	5 (23.8 %)	0.13
Pneumonia	5 (5.0 %)	0 (0 %)	0.59
Urinary tract infection	4 (4.0 %)	3 (14.3 %)	0.10
All infections	14 (13.9 %)	6 (28.6 %)	0.11
Ileus	7 (6.9 %)	1 (4.8 %)	1.00
Urinary retention	10 (9.9 %)	3 (14.3 %)	0.70
Seromas	18 (17.8 %)	5 (23.8 %)	0.54
All complications	44 (43.6 %)	11 (52.4 %)	0.81
Length of stay	2.1 ± 0.34	3.0 ± 0.76	0.28
Readmission	2 (2.0 %)	2 (9.5 %)	0.14
Late outcomes (>30 days)			
Recurrence	9 (8.9 %)	8 (38.1 %)	0.002
Eventration	47 (46.5 %)	15 (71.4 %)	0.054
Bowel obstruction	2 (2.0 %)	1 (4.8 %)	0.44
Reoperation	3 (3.0 %)	5 (23.8 %)	0.30
Patient satisfaction	8.4 ± 0.22	5.8 ± 0.73	0.0001
Cosmetic satisfaction	8.4 ± 0.23	5.5 ± 0.82	0.0001
Worst pain	2.1 ± 0.29	6.7 ± 0.59	0.0001
AAS	75.5 ± 1.2	70.9 ± 2.6	0.048
Follow-up	24 (6–133)	24 (8–134)	0.30

[a] Attending surgeon assigned as surgeon 1–7

Table 3 Functional status (Activities Assessment Scale; AAS)

	AAS ≥70 ($n = 90$)	AAS <70 ($n = 32$)	p value
Demographics			
Age	56 ± 1.2	59.9 ± 1.5	0.0495
Gender			0.21
M	68 (75.6 %)	28 (75.6 %)	
F	22 (24.4 %)	4 (24.4 %)	
Ethnicity			0.31
Caucasian	74 (82.2 %)	23 (81.1 %)	
Black	16 (17.8)	9 (16.7 %)	
Co-morbidities			
ASA			0.043
4	3 (3.3 %)	0 (0 %)	
3	51 (56.7 %)	27 (84.4 %)	
2	31 (34.4 %)	4 (12.5 %)	
1	5 (5.6 %)	1(3.1 %)	
BMI	33 ± 0.72	32 ± 1.00	0.39
Coronary artery disease	22 (24.4 %)	11 (34.4 %)	0.35
COPD	9 (10 %)	8 (25 %)	0.07
Prostate disease	31 (34.4)	12 (37.5 %)	0.83
Diabetes mellitus	27 (30 %)	10 (31.3 %)	1.00
Smoking	26 (28.9 %)	11 (34.4 %)	0.66
Alcohol abuse	10 (11.1 %)	8 (25 %)	0.08

Table 3 continued

	AAS ≥70 ($n = 90$)	AAS <70 ($n = 32$)	p value
Hernia data			
Grade			0.48
4	0 (0 %)	0 (0 %)	
3	13 (14.4 %)	5 (15.6 %)	
2	64 (71.1 %)	25 (78.1 %)	
1	13 (14.4 %)	2 (6.3 %)	
Hernia width	4.3 ± 0.32	4.3 ± 0.62	0.93
Hernia length	6.1 ± 0.57	5.7 ± 0.88	0.71
Hernia area	28.1 ± 4.6	27.6 ± 8.5	1.00
Secondary hernia	50 (55.6 %)	23 (81.9 %)	0.14
Primary hernia	40 (44.4 %)	9 (28.1 %)	
Recurrent hernia	23 (25.6 %)	7 (21.9 %)	0.81
Number prior abdominal surgeries	1.2 ± 0.12	1.3 ± 0.21	0.52
Operative data			
Surgeon[a]			0.23
Mesh type			0.006
Polypropelene	64 (71.1 %)	23 (71.9 %)	
Polyester	19 (21.1 %)	1 (3.1 %)	
Polytetrafluoroethylene	7 (7.8 %)	8 (25 %)	
Permanent sutures	76 (84.4 %)	26 (81.3 %)	0.58
TCCD	26 (28.9 %)	2 (6.3 %)	0.007
Early outcomes (≤30 days)			
Surgical site infection	9 (10 %)	6 (18.9 %)	0.22
Pneumonia	2 (2.2 %)	3 (9.4 %)	0.11
Urinary tract infection	3 (3.3 %)	4 (12.5 %)	0.08
All infections	12 (13.3 %)	8 (25 %)	0.16
Ileus	5 (5.6 %)	3 (9.4 %)	0.43
Urinary retention	9 (10 %)	4 (12.5 %)	0.74
Seromas	14 (15.6 %)	10 (31.3 %)	0.07
All complications	35 (38.9 %)	20 (62.5 %)	0.02
Length of stay	1.68 ± 0.16	3.72 ± 1.08	0.004
Readmission	3 (3.3 %)	1 (3.1 %)	1.00
Late outcomes (>30 days)			
Recurrence	7 (7.8 %)	7 (21.9 %)	0.0493
Eventration	41 (45.6 %)	21 (65.6 %)	0.06
Bowel obstruction	1 (1.1 %)	2 (6.3 %)	0.17
Reoperation	6 (6.7 %)	2 (6.3 %)	1.00
Patient satisfaction	8.7 ± 0.22	5.9 ± 0.53	0.0001
Cosmetic satisfaction	8.1 ± 0.27	7.1 ± 0.59	0.06
Worst pain	2.2 ± 0.30	5.0 ± 0.66	0.0001
Chronic pain	12 (13.3 %)	9 (28.1 %)	0.10
Follow-up	24 (6–132)	24 (6–134)	0.40

[a] Attending surgeon assigned as surgeon 1–7

Patient demographics, co-morbidities, hernia data, operative data, radiographic data, and outcomes were abstracted from the electronic medical records. The attending surgeon was recorded as a variable for outcomes and was identified by number, Surgeon 1 through Surgeon 7. Our primary outcomes (i.e., patient satisfaction, chronic pain, and functional status) were obtained by clinical follow-up. Starting in 2010, we employed standardized patient follow-up for ventral hernia repairs to assess both standard outcomes and patient quality of life outcomes. For quality control and assessment, we contacted patients for clinical follow-up and examination. Local patients were encouraged to follow-up clinically for examination and assessment. For those who were not local or who were reluctant to return for a clinic visit, a telephone interview was substituted.

Table 4 Multivariate analysis of factors associated with decreased patient satisfaction, chronic pain, and decreased functional status

	Odds ratio	95 % Confidence interval	p value
Decreased patient satisfaction			
Cosmetic satisfaction	17.3	4.8–62.5	0.0001
Eventration	10.2	2.2–47.1	0.003
Pain (chronic)	1.4	1.2–1.7	0.0005
Chronic pain			
Incisional hernia	9.0	2.0–56.0	0.008
Eventration	6.0	1.5–31.9	0.02
Recurrence	4.3	1.1–17.2	0.03
Mesh type (ref: polyester)	1.9	1.59–1.98	0.003
Ethnicity (ref: Caucasian)	0.10	0.02–0.04	0.003
Decreased functional status			
Mesh type (ref: polyester)	3.7	1.1–13.6	0.04
Alcohol abuse	3.4	1.0–11.7	0.048
Pain (chronic)	1.3	1.2–1.5	<0.0001
Age	1.1	1.006–1.12	0.04

Patient satisfaction with the surgery and with cosmetic results was recorded on a 10-point Likert-type scale (1 = least satisfied, 10 = most satisfied). Chronic abdominal pain was a factor reported by the patient based on subjective experience. Postoperative pain scores were recorded as the level of worst abdominal pain experienced on a 10-point Likert-type scale (1 = least pain, 10 = most pain). Patient functional status was assessed from a series of 13 questions from the Activities Assessment Scale (AAS), where scores were converted to a 100-point scale (1 = worst functional status, 100 = best functional status) [31].

Secondary outcomes evaluated include recurrence, surgical site infection (SSI), seroma, and eventration. Recurrence was determined by radiographic data, clinical examination at follow-up, or reoperation reports. Surgical site infection was defined by the Centers for Disease Control and Prevention (CDC) established guidelines for superficial, deep, and organ/space infections [32]. Seromas were recorded if the patient had radiographic evidence of a

fluid collection or clinical evidence of a seroma, as noted by physician notes taken during physical examination on admission or at follow-up. Eventrations were determined if the patient had a clinical bulge noted at follow-up or on a computed tomography (CT) scan, which was considered evidence of mesh protrusion beyond the anterior plane of the abdominal wall.

Statistical analysis

Patient-centered outcome data were divided accorded to those patients judged to have good outcomes versus those judged to have poor outcomes. Poor patient satisfaction was defined as any score <7 on the 10-point Likert scale. Chronic pain was rated as a categorical variable. Poor functional status was defined as any AAS score <70 on the 100-point Likert scale.

Patient characteristics were assessed using a Student's *t* test, the χ^2 test, or Fisher's exact test depending on whether the variables were continuous or categorical. Ordinal variables such as postoperative pain scores were assessed with the Mann–Whitney *U* test. Any *p* value of 0.05 was considered to be statistically significant. Univariate logistic regression models were built to estimate the odds of patient satisfaction, chronic pain, and functional status when considering the effect of each variable separately.

Multivariate logistic regression models were built to assess the effect of a given predictor on the dependent variable (patient satisfaction, chronic pain, or functional status) while controlling for other predictors in the model. To identify the most significant predictors, a multivariate model was initially created including all variables with a *p* value <0.20 from the initial assessment of patient characteristics and was then reduced in a stepwise manner to identify the best fit according to the Akaike Information Criterion. Diagnostics of the multivariate logistic regression model were assessed, and validation was performed with a tenfold cross-validation. All statistical analysis was performed on the statistical software R [33–35].

Results

Of 201 patients evaluated, 122 patients had quality of life data on follow-up (Fig. 1). Ninety-one (74.5 %) patients were satisfied with their LVHR (patient satisfaction score ≥ 7), 101 (83.5 %) patients had no chronic abdominal pain following their LVHR, and 90 (73.8 %) patients had good functional status following their LVHR (AAS score ≥ 70).

Patient satisfaction results are shown in Table 1. On univariate analysis, female gender, mesh type, permanent transfascial sutures, and transcutaneous closure of central defects (TCCD) were associated with improved patient satisfaction. Patients with SSI, urinary tract infection, complication, readmission, recurrence, eventration, poor cosmetic satisfaction, chronic pain, or poor functional status had decreased overall satisfaction.

Comparative results of patients with and without chronic pain are shown in Table 2. On univariate analysis, black ethnicity, increased hernia size, incisional hernias, mesh type, recurrence, poor patient satisfaction, poor cosmetic

Table 5 Review of the literature

Author	Year	#	Surgery	Hernia	Satisfied	Chronic pain	QOL	Conclusions
Gronnier et al. [23]	2012	109	Open	Incisional	n/a	31 (28 %)	n/a	Chronic cough predicts chronic pain
Ladurner et al. [24]	2011	24	Open	Incisional	n/a	n/a	SF-36	LW and HW mesh no differences in OVHR
Snyder et al. [25]	2011	361	Mixed	Incisional	319 (88.4 %)	149 (41 %)	SF-36	Recurrences decrease patient-reported outcomes but surgical technique does not.
Wassenaar et al. [26]	2010	143	Laparoscopic	Incisional	n/a	VAS	SF-36	Mesh fixation method did not affect pain of QOL
Poelman et al. [27]	2010	71	Open	Incisional	53 (75 %)	n/a	Karnofsky scale SF-36	Onlay ok for QOL
Eriksen et al. [28]	2009	35	Laparoscopic	Ventral	n/a	5 (7 %)	VAS-gwb SF-36	Pain affected patient satisfaction and QOL
Uranues et al. [29]	2008	85	Laparoscopic	Recurrent Incisional	n/a	6 (7.0 %)	GIQLI	LVHR improves QOL
Hope et al. [30]	2007	56	Mixed	Ventral	n/a	n/a	SF-36 CCS	LVHR > OVHR

satisfaction, and decreased functional status were associated with chronic pain.

Functional status outcomes are shown in Table 3. Older patients, patients with higher ASA score, mesh type, and failure to close the central defect (TCCD) were all associated with decreased functional status following LVHR. Patients who had any complication, recurrence, eventration, decreased satisfaction, or elevated late pain scores also had poorer function.

On multivariate analysis, low cosmetic satisfaction scores, eventration, and chronic pain were associated with decreased patient satisfaction (Table 4). Incisional hernias, eventration, and hernia recurrence were associated with chronic pain, along with mesh type used and Caucasian race (Table 4). Mesh type, alcohol abuse, chronic pain, and older age were associated with decreased functional status (Table 4).

Conclusions

In this study, we noted one fourth of patients were dissatisfied following their LVHR due to chronic pain and poor functional status, among other factors. These quality of life factors are interrelated. Chronic abdominal pain was associated with decreased patient satisfaction and poor function. In addition, continued bulging following LVHR due to eventration or recurrence was associated with decreased patient satisfaction and chronic pain.

Patient satisfaction with VHR has been reported to range from 75 to 88.4 % (Table 5) [25, 27]. Our study is consistent with these results. Unlike other studies, however, we noted that patient satisfaction with VHR is associated with satisfaction in abdomen appearance following repair, along with chronic pain. Patient dissatisfaction increased tenfold due to continued bulging although the repair was successful when measured by traditional surgical standards. Cosmetic factors had the strongest effect on patient satisfaction.

Surprisingly, factors such as hernia recurrence, SSI, or complications did not contribute to patient satisfaction on the multivariate analysis. This may be because many of the complications were early postoperative events and long-term recall may have attenuated their effect. Bulging or eventration had a greater effect on patient satisfaction than true hernia recurrence.

Prevalence of chronic pain following VHR ranges from 7 to 41 % (Table 5) [23, 25–27, 29]. Prior studies have associated chronic cough, recurrence, patient satisfaction/quality of life, and open repair with chronic pain [23, 25, 28, 29]. In our study we noted that incisional hernias were associated with chronic pain. This is to be expected, as these hernias tend to be larger and more complicated than primary hernias, such as umbilical or epigastric hernias. Consistent with other studies, we noted that recurrence was related to chronic pain [25]; however, we also found that eventration was associated with chronic pain. This may be because larger hernias (i.e., incisional hernias) are more likely to bulge with LVHR.

Additionally, we noted that mesh type (specifically polypropylene and polytetrafluoroethylene) was associated with increased rates of chronic pain. While many studies have demonstrated that low-density (i.e., misnomer "light weight mesh") meshes are associated with improved patient satisfaction in groin hernias [36], other studies have also suggested that low-density meshes are associated with increased hernia recurrence, particularly with ventral hernias [24]. The effect and role of low-density meshes remains to be elucidated with ventral hernias, particularly incisional hernias.

Our analysis suggests that Caucasian patients may have an increased incidence of chronic pain. This may be due to the relative homogeneity of our study population. Alternatively, without preoperative chronic pain scores, this ethnic difference may simply be a manifestation of preoperative differences.

Few studies have evaluated functional status, instead focusing on quality of life (Table 5) [24, 25, 27–30]. The SF-36 questionnaire is the most common method of evaluating patient quality of life in VHR studies. In prior research, recurrence, chronic pain, and laparoscopic repair improved patient quality of life.

In our study, we opted to focus on functional status with the Activities Assessment Scale [32]. We noted that baseline characteristics such as older age and alcohol abuse were associated with diminished function. Our model also suggested that chronic pain and mesh type affected patient function. Many recent studies have suggested that low-density meshes are associated with improved patient function [24]. However, similar to chronic pain, low-density meshes resulted in poorer function in our study, possibly because of increased bulging or hernia recurrence that other studies have associated with low-density meshes.

Our study has several limitations. First, its retrospective nature introduces a number of biases into the results. For example, while we corrected for surgeon, several other variables could affect our results: variation in operative technique, postoperative management, and bedside manner. Second, patient-centered outcomes were only recorded for 61 % of our cohort overall. Patients who died or patients who were lost to follow-up may have contributed to non-responder bias. However, compared to other studies, we had robust follow-up. Third, without baseline or preoperative patient-centered outcomes, it can be difficult to gauge whether lower quality of life measures were due to preoperative factors as opposed to operative factors [37].

While we took into account baseline information, none can quite capture preoperative poor functional status or preoperative chronic pain [37]. Finally, as this study included patients from a Veteran's Affairs Medical Center, the applicability of our results to younger, healthier, or more female populations should be approached with caution.

In conclusion, our study suggests that patient satisfaction, chronic pain, and functional status are all interrelated. Patient satisfaction is affected largely by cosmetic outcomes, though chronic pain does influence perception. Chronic pain is associated with incisional hernias, recurrence, and eventration. Mesh type and ethnicity may also play a role. Functional status is affected by baseline characteristics such as age and alcohol abuse; however, chronic pain and mesh type used may affect function as well. While standard outcomes affect patient-reported outcomes, factors most important to patients may differ from those most important to surgeons. In future studies, patient-reported outcomes should receive equal focus to that on more traditional outcomes.

References

1. Poulose BK, Shelton J, Phillips S et al (2011) Epidemiology and cost of ventral hernia repair: making the case for hernia research. Hernia 16:179–183
2. Mudge M, Hughes LE (1985) Incisional hernia: a 10 year prospective study of incidence and attitudes. Br J Surg 72:70–71
3. Hesselink VJ, Luijendijk RW, de Wilt JH et al (1993) An evaluation of risk factors in incisional hernia recurrence. Surg Gynecol Obstet 176:228–234
4. Luijendijk RW, Hop WC, van den Tol MP et al (2000) A comparison of suture repair with mesh repair for incisional hernia. N Engl J Med 343:392–398
5. Burger JW, Luijendijk RW, Hop WC et al (2004) Long-term follow-up of a randomized controlled trial of suture versus mesh repair of incisional hernia. Ann Surg 240:578–585
6. Fitzgibbons RJ Jr, Giobbie-Hurder A, Gibbs JO et al (2006) Watchful waiting vs repair of inguinal hernia in minimally symptomatic men: a randomized clinical trial. JAMA 295: 285–292
7. Itani KM, Hur K, Kim LT et al (2010) Comparison of laparoscopic and open repair with mesh for the treatment of ventral incisional hernia: a randomized trial. Arch Surg 145:322–328
8. Kurmann A, Visth E, Candinas D et al (2011) Long-term follow-up of open and laparoscopic repair of large incisional hernias. World J Surg 35:297–301. doi:10.1007/s00268-010-0874-9
9. Hawn MT, Snyder CW, Graham LA et al (2010) Long-term follow-up of technical outcomes for incisional hernia repair. J Am Coll Surg 210:648–655
10. Asencio F, Aguiló J, Peiró S et al (2009) Open randomized clinical trial of laparoscopic versus open incisional hernia repair. Surg Endosc 23:1441–1448
11. Pring CM, Tran V, O'Rourke N et al (2008) Laparoscopic versus open ventral hernia repair: a randomized controlled trial. ANZ J Surg 78:903–906
12. Olmi S, Scaini A, Cesana GC et al (2007) Laparoscopic versus open incisional hernia repair: an open randomized controlled study. Surg Endosc 21:555–559
13. Barbaros U, Asoglu O, Seven R et al (2007) The comparison of laparoscopic and open ventral hernia repairs: a prospective randomized study. Hernia 11:51–56
14. Misra MC, Bansal VK, Kulkarni MP et al (2006) Comparison of laparoscopic and open repair of incisional and primary ventral hernia: results of a prospective randomized study. Surg Endosc 20:1839–1845
15. Carbajo MA, del Olmo JC, Blanco JI et al (2000) Laparoscopic treatment of ventral abdominal wall hernias: preliminary results in 100 patients. JSLS 4:141–145
16. Tse GH, Stutchfield BM, Duckworth AD et al (2010) Pseudorecurrence following laparoscopic ventral and incisional hernia repair. Hernia 14:583–587
17. Bencini L, Sanchez LJ, Bernini M et al (2009) Predictors of recurrence after laparoscopic ventral hernia repair. Surg Laparosc Endosc Percutan Tech 19:128–132
18. Franklin ME Jr, Gonzalez JJ Jr, Glass JL et al (2004) Laparoscopic ventral and incisional hernia repair: an 11-year experience. Hernia 8:23–27
19. Heniford BT, Park A, Ramshaw BJ et al (2003) Laparoscopic repair of ventral hernias: nine years' experience with 850 consecutive hernias. Ann Surg 238:391–399
20. Carbajo MA, del Olmo JC, Blanco JI et al (2003) Laparoscopic approach to incisional hernia. Surg Endosc 17:118–122
21. Rosen M, Brody F, Ponsky J et al (2003) Recurrence after laparoscopic ventral hernia repair. Surg Endosc 17:123–128
22. LeBlanc KA, Whitaker JM, Bellanger DE et al (2003) Laparoscopic incisional and ventral hernioplasty: lessons learned from 200 patients. Hernia 7:118–124
23. Gronnier C, Wattier JM, Favre H et al (2012) Risk factors for chronic pain after open ventral hernia repair by underlay mesh placement. World J Surg 36:1548–1554. doi:10.1007/s00268-012-1523-2
24. Ladurner R, Chiapponi C, Linhuber Q et al (2011) Long-term outcome and quality of life after open incisional hernia repair—light versus heavy weight meshes. BMC Surg 11:25
25. Snyder CW, Graham LA, Vick CC et al (2011) Patient satisfaction, chronic pain, and quality of life after elective incisional hernia repair: effects of recurrence and repair technique. Hernia 15:123–129
26. Wassenaar E, Schoenmaeckers E, Raymakers J et al (2010) Mesh-fixation method and pain and quality of life after laparoscopic ventral or incisional hernia repair: a randomized trial of three fixation techniques. Surg Endosc 24:1296–1302
27. Poelman M, Schellekens JF, Langenhorst BLAM et al (2010) Health-related quality of life in patients treated for incisional hernia with onlay technique. Hernia 14:237–242
28. Eriksen JR, Poornoroozy P, Jorgensen LN et al (2009) Pain, quality of life, and recovery after laparoscopic ventral hernia repair. Hernia 13:13–21
29. Uranues S, Salehi B, Bergamaschi R (2008) Adverse events, quality of life, and recurrence rates after laparoscopic adhesiolysis and recurrent incisional hernia mesh repair in patients with previous failed repairs. J Am Coll Surg 207:663–669
30. Hope WW, Lincourt AE, Newcomb WL et al (2007) Comparing quality-of-life outcomes in symptomatic patients undergoing laparoscopic or open ventral hernia repair. J Laparoendosc Adv Surg Tech 18:567–571
31. McCarthy M Jr, Jonasson O, Chang CH et al (2005) Assessment of patient functional status after surgery. J Am Coll Surg 201:171–178
32. http://www.cdc.gov/nhsn/PDFs/pscManual/9pscSSIcurrent.pdf. Accessed 18 Nov 2011

33. Agresti A (2002) Categorical data analysis, 2nd edn. John Wiley, Hoboken
34. Kutner MH, Natchtsheim CJ, Neter J et al (2005) Applied linear statistical models, 5th edn. McGraw-Hill Irwin, New York
35. R Development Core Team (2012) R: a language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. ISBN 3-900051-07-0. http://www.R-project.org/
36. Sajid MS, Leaver C, Baig MK et al (2012) Systematic review and meta-analysis of the use of lightweight versus heavyweight mesh in open inguinal hernia repair. Br J Surg 99:29–37
37. Albright EL, Davenport DL, Roth JS (2012) Preoperative functional health status impacts outcomes after ventral hernia repair. Am Surg 78:230–234