Incisional hernia is a common complication after abdominal surgery, with reported incidences varying from 5% to 20%. In recent years, the surgery for incisional hernias has undergone a tremendous development with the introduction of new prosthetic material, laparoscopic methods, and component separation. This has led to an overall reduction in recurrence rates, and thus an increased attention has been directed toward other outcomes such as quality of life. Several factors may influence quality of life after incisional hernia repair such as pain, mobility impairment, cosmetics, and length of convalescence. Besides, patient-reported outcome results are not only important to the patient, but also a factor highly relevant in the ongoing cost-effectiveness debate. The purpose of this study was to review the existing literature examining quality of life by standardized methods after incisional hernia repair.

Methods

A PubMed and EMBASE search from January 1980 to November 2013 was carried out with the search terms “incisional hernia AND quality of life” combined with the Medical Subject Headings terms “pain,” “pain measurement,” “questionnaires,” and “hernia, ventral.” Filter options selected were publication type “articles” and
language “English.” Inclusion criteria were studies that used a standardized method to examine quality of life in patients who had undergone incisional hernia repair. Studies reporting quality of life by nonstandardized methods were excluded, and pain assessment tools were not part of the inclusion criteria. Abstracts, case reports, and letters to the editor were not included.

Results

A total of 26 studies were included (Fig. 1) reporting quality of life by a standardized method after incisional hernia repair (Table 1). The timing of quality of life assessments varied from the first postoperative day to 5.6 years after surgery. A preoperative quality of life assessment was performed in 16 of the 26 studies (62%). Eight different quality of life measurement methods were used and in 2 studies 2 different methods were used (Table 2).

Short-Form 36

The most common method for measuring quality of life was the Short-Form 36, which was used in 14 studies. Short-Form 36 was originally derived from the Medical Outcome Study and is a health survey instrument comprised of 36 items, which assess 8 different health concepts (physical functioning, role physical, bodily pain, general health perceptions, vitality, social functioning, role emotional, and mental health) and summarizes into 2 main outcomes: physical and mental health score. It takes 7 to 10 minutes for a patient to self-administer and in general, the Short-Form 36 is the most frequently used quality of life assessment tool. The Short-Form 36 is neither disease- nor treatment specific, and therefore not restricted to surgical patients.

Five studies reported quality of life after open mesh repair. Three studies comparing different types of meshes found no differences in quality of life at 6 and 24 months follow-up, respectively. Tollens et al reported a long-term follow-up of 4 years of 135 patients treated with sublay mesh repair, of whom 18 patients had recurrent incisional hernias. The main finding in this study was that hernia recurrence had a significantly negative effect on quality of life with regard to both physical functioning and general health, as compared with no recurrence. One study examined quality of life in 69 patients treated for an incisional hernia with onlay mesh repair and after 64 months of follow-up, the quality of life was comparable with a matched control group of patients without hernia.

![Figure 1](Literature search flow chart.)
<table>
<thead>
<tr>
<th>Reference</th>
<th>n</th>
<th>Procedure</th>
<th>Preoperative assessment</th>
<th>Follow-up</th>
<th>QOL assessment</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Räsänen et al</td>
<td>20</td>
<td>NS</td>
<td>Yes</td>
<td>2 and 12 months postoperative</td>
<td>15D</td>
<td>Improved QOL after surgery (hernia repair, fundoplication, cholecystectomy, and bowel resection)</td>
</tr>
<tr>
<td>Colavita et al</td>
<td>710</td>
<td>Laparoscopic or open mesh repair</td>
<td>Yes</td>
<td>1, 6, and 12 months postoperative</td>
<td>CCS</td>
<td>Laparoscopic repair is associated with decreased QOL in the short term compared with open</td>
</tr>
<tr>
<td>Klima et al</td>
<td>228</td>
<td>Open component separation or standard open mesh repair</td>
<td>Yes</td>
<td>&lt;1 month and 6–12 months postoperative</td>
<td>CCS</td>
<td>Similar QOL outcomes with the 2 techniques</td>
</tr>
<tr>
<td>Wormer et al</td>
<td>865</td>
<td>Laparoscopic or open repair</td>
<td>No</td>
<td>1, 6, 12, and 24 months postoperative</td>
<td>CCS</td>
<td>Patients with large defect area and transverse defect width have higher odds of pain postoperatively</td>
</tr>
<tr>
<td>Tsirline et al</td>
<td>512</td>
<td>Open mesh or laparoscopic repair</td>
<td>Yes</td>
<td>2 weeks, 4 weeks, and 6 months postoperative</td>
<td>CCS</td>
<td>Preoperative pain is a predictor of postoperative pain. Most patients experience resolution of symptoms after 6 months</td>
</tr>
<tr>
<td>Asencio et al</td>
<td>84</td>
<td>Laparoscopic or open mesh repair</td>
<td>No</td>
<td>1, 2, 3, 7, 15 days, and 1, 3, 12 months postoperative</td>
<td>EuroQol-5D</td>
<td>No difference in QOL in regard to technique</td>
</tr>
<tr>
<td>Marchesi et al</td>
<td>41</td>
<td>Open and laparoscopic repair</td>
<td>No</td>
<td>1 month postoperative</td>
<td>Gastrointestinal Quality of Life Index</td>
<td>No difference in QOL when comparing laparoscopic and open repair</td>
</tr>
<tr>
<td>Korenkov et al</td>
<td>160</td>
<td>Suture repair, autodermal skin graft, or onlay mesh repair</td>
<td>No</td>
<td>1 year postoperative</td>
<td>Gastrointestinal Quality of Life Index</td>
<td>No difference in QOL regarding choice of technique</td>
</tr>
<tr>
<td>Paul et al</td>
<td>88</td>
<td>Open suture repair</td>
<td>No</td>
<td>5.7 years postoperative (mean)</td>
<td>Gastrointestinal Quality of Life Index</td>
<td>Patients who underwent suture repair had impaired physical function compared with healthy individuals</td>
</tr>
<tr>
<td>Uranues et al</td>
<td>85</td>
<td>Laparoscopic mesh repair</td>
<td>Yes</td>
<td>2 years postoperative</td>
<td>Gastrointestinal Quality of Life Index</td>
<td>Improved QOL at follow-up</td>
</tr>
<tr>
<td>Krpata et al</td>
<td>88</td>
<td>Open and laparoscopic repair</td>
<td>Yes</td>
<td>2 weeks, 4 weeks, and 6 months postoperative</td>
<td>HerQles</td>
<td>Improved QOL after hernia repair</td>
</tr>
<tr>
<td>Canziani et al</td>
<td>40</td>
<td>Open mesh fibrin glue repair</td>
<td>Yes</td>
<td>1 year postoperative</td>
<td>SF-12</td>
<td>Reduced pain and physical component score after surgery</td>
</tr>
<tr>
<td>Conze et al</td>
<td>165</td>
<td>Sublay lightweight composite or polypropylene mesh repair</td>
<td>Yes</td>
<td>21 days, 4, 12, and 24 months</td>
<td>SF-36</td>
<td>No significant difference in outcomes</td>
</tr>
</tbody>
</table>

(continued on next page)
<table>
<thead>
<tr>
<th>Reference</th>
<th>n</th>
<th>Procedure</th>
<th>Preoperative assessment</th>
<th>Follow-up</th>
<th>QOL assessment</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ladurner et al⁹⁹</td>
<td>24</td>
<td>Open sublay repair with light or heavyweight mesh</td>
<td>No</td>
<td>112 or 75 months postoperative</td>
<td>SF-36</td>
<td>No difference in QOL regarding type of mesh</td>
</tr>
<tr>
<td>Mussack et al¹³</td>
<td>48</td>
<td>Laparoscopic or open sublay mesh repair</td>
<td>Yes</td>
<td>16 or 28 months postoperative</td>
<td>SF-36</td>
<td>No differences in long-term QOL between open and laparoscopic repair</td>
</tr>
<tr>
<td>Tollens et al¹¹</td>
<td>18</td>
<td>Open sublay mesh repair</td>
<td>No</td>
<td>49 months postoperative (mean)</td>
<td>SF-36</td>
<td>Hernia recurrence has a negative effect on QOL</td>
</tr>
<tr>
<td>Itani et al¹⁴</td>
<td>146</td>
<td>Open mesh or laparoscopic repair</td>
<td>Yes</td>
<td>2 weeks, 8 weeks, and 12 months postoperative</td>
<td>SF-36</td>
<td>Improved QOL after surgery, no differences between open and laparoscopic</td>
</tr>
<tr>
<td>Bansal et al¹⁸</td>
<td>50</td>
<td>Laparoscopic mesh repair with tackers or sutures</td>
<td>Yes</td>
<td>3 months postoperative</td>
<td>SF-36</td>
<td>Improved QOL at follow-up. No difference in QOL between the 2 groups</td>
</tr>
<tr>
<td>Eriksen et al¹⁷</td>
<td>35</td>
<td>Laparoscopic mesh repair</td>
<td>Yes</td>
<td>30 days and 6 months postoperative</td>
<td>SF-36</td>
<td>Significantly affected QOL up to 6 months after surgery</td>
</tr>
<tr>
<td>Muysoms et al²⁰</td>
<td>76</td>
<td>Laparoscopic repair with double crown or transfacial sutures and one row of tackers</td>
<td>Yes</td>
<td>3 months postoperative</td>
<td>SF-36</td>
<td>Sutures and tackers group had higher VAS scores after 3 months, similar QOL</td>
</tr>
<tr>
<td>Rogmark et al¹⁶</td>
<td>133</td>
<td>Laparoscopic repair or open sublay mesh repair</td>
<td>Yes</td>
<td>1.5, 3, 4, and 6 weeks postoperative</td>
<td>SF-36</td>
<td>Laparoscopic repair leads to better physical function</td>
</tr>
<tr>
<td>Wassenaar et al¹⁹</td>
<td>199</td>
<td>Laparoscopic repair: absorbable sutures with tacks, double crown, or nonabsorbable sutures</td>
<td>Yes</td>
<td>3 months postoperative</td>
<td>SF-36</td>
<td>No difference in VAS or QOL in regard to fixation technique</td>
</tr>
<tr>
<td>Rickert et al¹⁰</td>
<td>80</td>
<td>Open sublay nonabsorbable/ absorbable mesh</td>
<td>No</td>
<td>21 days and 6 months</td>
<td>SF-36</td>
<td>Similar outcomes with 2 different meshes</td>
</tr>
<tr>
<td>Snyder et al²¹</td>
<td>361</td>
<td>Various incisional hernia repairs</td>
<td>No</td>
<td>56–62 (median)</td>
<td>SF-36</td>
<td>Repair technique has no independent effect on patient satisfaction, chronic pain, or QOL</td>
</tr>
<tr>
<td>Hope et al¹⁵</td>
<td>56</td>
<td>Laparoscopic or open mesh repair</td>
<td>Yes</td>
<td>At least 6 months</td>
<td>SF-36 and CCS</td>
<td>Improved QOL with laparoscopic repair compared with open</td>
</tr>
<tr>
<td>Poelman et al¹²</td>
<td>69</td>
<td>Open onlay mesh repair</td>
<td>No</td>
<td>64 months (mean)</td>
<td>SF-36 and Karnofsky Performance Status Scale</td>
<td>QOL comparable with matched controls. Karnofsky Performance Status Scale score: patients had some signs of disease</td>
</tr>
</tbody>
</table>

CCS = Carolinas Comfort Scale; HerQLes = Hernia-Related Quality-of-Life Survey; NS = not stated; QOL = quality of life; SF-12 = Short-Form 12; SF-36 = Short-Form 36; VAS = Visual Analogue Scale.
<table>
<thead>
<tr>
<th>Name</th>
<th>Times used</th>
<th>Hernia specific</th>
<th>No. of questions</th>
<th>Output</th>
<th>Physical components</th>
<th>Mental components</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short-Form 36</td>
<td>14</td>
<td>No</td>
<td>36</td>
<td>Physical and mental health summary score</td>
<td>Physical functioning, role limitations caused by physical health problems, energy/fatigue, and pain</td>
<td>Role limitations caused by emotional problems, social functioning, emotional well-being, and general health perceptions</td>
</tr>
<tr>
<td>Short-Form 12</td>
<td>1</td>
<td>No</td>
<td>12</td>
<td>Physical and mental health summary score</td>
<td>Physical functioning, role limitations caused by physical health problems, energy/fatigue, and pain</td>
<td>Role limitations caused by emotional problems, social functioning, emotional well-being, and general health perceptions</td>
</tr>
<tr>
<td>Carolinas Comfort Scale</td>
<td>5</td>
<td>Yes</td>
<td>23</td>
<td>Score of 0: 115</td>
<td>Pain, movement limitation, and mesh sensation for 8 different daily activities</td>
<td>None</td>
</tr>
<tr>
<td>Gastrointestinal Quality of Life Index</td>
<td>4</td>
<td>No</td>
<td>36</td>
<td>Score of 0: 144</td>
<td>Physical role, large bowel function, upper gastrointestinal tract function, and meteorism</td>
<td>Emotional role</td>
</tr>
<tr>
<td>EuroQol-5D</td>
<td>1</td>
<td>No</td>
<td>5</td>
<td>Score of 0: 1 (being dead—perfect health)</td>
<td>Mobility, self-care, usual activities, and pain/discomfort</td>
<td>Anxiety/depression, and a visual analog health perception scale</td>
</tr>
<tr>
<td>Karnofsky Performance Status Scale 15D</td>
<td>1</td>
<td>No</td>
<td>1</td>
<td>Decimal score of 0: 100</td>
<td>None</td>
<td>Measure of self-perceived health status</td>
</tr>
<tr>
<td>Hernia-Related Quality-of-Life Survey</td>
<td>1</td>
<td>Yes</td>
<td>12</td>
<td>Score of 0: 100</td>
<td>Specific questions on core functioning and its effect on quality of life and abdominal wall function, concerning both physical and mental components</td>
<td>None</td>
</tr>
</tbody>
</table>
Short-Form 36 has been used to assess quality of life after laparoscopic incisional hernia repair in 9 studies. No difference in quality of life after laparoscopic or open sublay repair was found in 2 studies, but quality of life after hernia repair was lower than that of healthy controls. In contrast, Hope et al. found that laparoscopic ventral or incisional hernia repair resulted in a significant improvement in quality of life compared with open sublay mesh repair. In this study, both Short-Form 36 and the Carolinas Comfort Scale (described below) were used to assess quality of life, both supporting the superiority of the laparoscopic technique. Somewhat similar findings were reported in a study comparing laparoscopic and open sublay mesh repair in 133 patients. Short-term physical functioning was significantly improved in patients treated with laparoscopic approach compared with open repair, although no difference was found in general health. One study assessed quality of life in laparoscopic repair employing double-crown titanium tacks, and reported decreased quality of life in 3 domains (role physical, bodily pain and physical component scale) 1 month postoperative. However, the findings were normalized after 6 months when overall quality of life was comparable with healthy individuals. Three studies compared quality of life measured by Short-Form 36 after laparoscopic incisional hernia repair with different mesh fixation techniques and found no difference in overall quality of life, although a decrease in physical functioning and role limitations because of emotional problems was found after application of tackers with the double-crown technique. Finally, Snyder et al. reported that the use of mesh or suture for incisional hernia repair has no influence on quality of life measured by Short-Form 36 after 5 years.

The Short-Form 12

The Short-Form 12 is a shorter version of the aforementioned Short-Form 36 that provides only a physical and mental component. It has been shown to give results comparable with Short-Form 36, with far less respondent burden. One study has used Short-Form 12 to assess changes in quality of life after sutureless mesh fibrin glue incisional hernia repair. It was observed that this technique led to an improved quality of life in the physical component score, while the mental component score was unaffected.

Carolinas Comfort Scale

Five studies analyzed quality of life after incisional hernia repair with the Carolinas Comfort Scale method, which is a 23-item questionnaire measuring severity of pain, sensation, and mobility impairment from an implanted mesh in 8 different categories. It is a hernia-specific questionnaire aiming on patients treated with a mesh. In addition to the aforementioned study, 3 other studies assessed quality of life by the use of Carolinas Comfort Scale. Two studies originating from the International Hernia Mesh Registry analyzed quality of life after ventral hernia repair by open and laparoscopic approach, using various techniques. Both incisional and primary ventral hernias were included in both studies. One reported that laparoscopic repair was associated with a decrease in quality of life (discomfort, activity limitation, and overall) after 1 month compared with open repair, but no long-term difference was found. Another study concluded that large defect width and total defect area were factors associated with decreased short-term quality of life in both laparoscopic and open incisional hernia repair. No difference was found at long-term follow-up. Tsirline et al. used the Carolinas Comfort Scale to analyze predictors for postoperative pain after open mesh and laparoscopic repair. It was reported that preoperative pain was the strongest predictor for postoperative pain, but in most cases pain had ceased at 6 months of follow-up. One study compared quality of life after open component separation incisional hernia repair and open mesh repair. Patients treated with the 2 different techniques had comparable hernia dimensions and comparable quality of life was reported.

The Gastrointestinal Quality of Life Index

A third method of measuring quality of life after incisional hernia repair is the Gastrointestinal Quality of Life Index, which is a disease-specific questionnaire designed for patients with gastrointestinal disorders. The questionnaire is comprised of 36 items each with 5 response categories. Together they yield a total quality of life score ranging from 0 to 144. One study used Gastrointestinal Quality of Life Index to examine long-term quality of life after open suture repair and found an overall decreased quality of life in patients treated for incisional hernia compared with healthy people and hernia recurrence did not influence the quality of life. Similar results were found when comparing Gastrointestinal Quality of Life Index-measured quality of life after either suture repair; mesh repair or autodermal skin graft repair in 160 patients with incisional hernias. After at least 9 months of follow-up, no differences in quality of life were found. Marchesi et al. used the Gastrointestinal Quality of Life Index to compare laparoscopic and open mesh repair in 41 patients, also reporting no difference in quality of life. Finally, one study used the Gastrointestinal Quality of Life Index to assess changes in quality of life after laparoscopic incisional hernia repair. An improvement in the total quality of life and the domain’s emotional function, physical function, and symptoms were reported when comparing scores before and 2 years after surgery.

Hernia-Related Quality-of-Life Survey

The Hernia-Related Quality-of-Life Survey is a hernia-specific quality of life assessment tool, consisting of 12 items that patients score from 1 to 6. One study has used Hernia-Related Quality-of-Life Survey to assess quality of life upon hernia repair by laparoscopic and open mesh repair in 116 patients with incisional hernias.
life in patients undergoing open mesh or laparoscopic repair for primary and incisional hernia, reporting improved quality of life after 4 weeks but no further improvement after 6 months.34

**Karnofsky Performance Status Scale**

Karnofsky Performance Status Scale is a measure of functional performance on a scale from 0 to 100. A score of 100 indicates that the patient can fully function and perform all activities of daily life with no evidence of disease, while a score of 0 is death. The scale was originally developed for evaluation in cancer patients, but has proved a valid tool in the assessment of patients with a chronic disease.35 The Karnofsky Performance Status Scale has been used in one previously mentioned study.12 In this study of onlay mesh repair, the Karnofsky Performance Status Scale score indicated that activities could be performed with effort and that patients had some signs of disease, indicating that the Karnofsky Performance Status Scale did detect some degree of decreased quality of life that was not detected by Short-Form 36.

**EuroQol**

The EuroQol is a health-related quality of life scale, which consists of 5 questions concerning usual activity, self-care, mobility, pain or discomfort, and anxiety or depression. After the patient has answered these questions, a value between 0 and 1 is calculated, 0 being “death” and 1 “perfect health.”36 The EuroQol has been used to compare laparoscopic and/or open inlay or onlay mesh repair of incisional hernia, and no differences in quality of life after 1 year of follow-up were reported.37 However, quality of life was decreased initially after surgery but improved until 1 year postoperatively.

**15D**

Finally, one study analyses quality of life after various surgical procedures, including open incisional hernia repair with and without mesh (n = 20), using the 15D questionnaire.38 The 15D is a generic, 15-dimensional, standardized questionnaire, which describe 15 different dimensions: breathing, mental function, speech, vision, mobility, usual activities, vitality, hearing, eating, elimination, sleeping, distress, discomfort and symptoms, sexual activity, and depression. Each dimension is stratified into 5 levels and transforms into a total score ranging from 0 to 1.39 In this study, no difference in quality of life was found when comparing preoperative status with follow-up results at 2 and 12 months.

**Comments**

Eight different standardized methods of measuring health-related quality of life after incisional hernia repair were identified in the current review. Two methods were hernia specific, while one was specific for gastrointestinal disorders. The most common questionnaire was the Short-Form 36, which is thoroughly validated and widely used.40 For these reasons the Short-Form 36 scores are easy to compare with other studies, which is desirable for a number of reasons. The main disadvantage of Short-Form 36 for evaluation of any surgical procedure is that it is generic and not disease specific and therefore prone to be affected by factors not associated with surgery.41 This also applies to the other generic questionnaires described in this review: Short-Form 12, EuroQol, Karnofsky Performance Status Scale, and 15D. Especially the Karnofsky Performance Status Scale, which was originally developed for evaluating cancer patients before initiation of chemotherapy, seems misplaced in the evaluation of a surgical procedure.

While the disease-specific Gastrointestinal Quality of Life Index may be more relevant when assessing quality of life after incisional hernia repair, it too has its limitations, as subscales such as digestion and defecation are not affected by an incisional hernia. A more specific evaluation of quality of life in patients treated for an incisional hernia is possible with Hernia-Related Quality-of-Life Survey or Carolinas Comfort Scale, which to our knowledge are the only of their kind. Reliability and validity studies of the Carolinas Comfort Scale compared with Short-Form 36 has been done by the authors behind the Carolinas Comfort Scale, claiming that it is superior to Short-Form 36 when studying quality of life in patients undergoing surgical hernia repair.42 Carolinas Comfort Scale may be best suited for relatively symptomatic patients, but it is still a highly specific and relevant questionnaire when examining changes in quality of life related to a single procedure. The importance of a disease-specific quality of life questionnaire is underlined by the fact that other conditions such as depression play a significant role when using generic questionnaires.32 Equal to Carolinas Comfort Scale, Hernia-Related Quality-of-Life Survey has proved its validity in a single study,34 but the value of this questionnaire awaits more studies.

An important question when examining quality of life after surgical procedures is when to do the follow-up. To examine the impact of surgery, an assessment must be done pre- and postoperatively. Only half of the studies included a preoperative quality of life assessment. Furthermore, it remains unclear as to how long after incisional hernia repair the optimal assessment should be undertaken. In this review, several studies reported a decreased quality of life immediately after surgery, which returned to the preoperative level or higher subsequently. In orthopedic surgery, a recent review concluded that a follow-up of 12 months is desirable when assessing quality of life after hip and knee replacement,44 but of course this recommendation may be of little relevance for hernia surgery. Because no consensus on the method of measuring quality of life after incisional hernia repair exists, results are seldom comparable. Furthermore, the length of follow-up is infrequently comparable, which complicates comparisons even more.

Another important issue when evaluating quality of life after incisional hernia repair is, which control group to use.
Several studies compared postoperative quality of life after incisional hernia repair with a group of healthy controls not having hernias and not undergoing surgery. One may argue that this comparison is irrelevant. To the best of our knowledge, there are no randomized controlled trials comparing quality of life in symptomatic incisional hernia patients randomized to surgery or watchful waiting strategy, meaning that the true impact of incisional hernia surgery on quality of life is in fact unknown.

Other ways of measuring subjective outcomes of incisional hernia repair are found in the literature. In 9 of the included studies in this review, the quality of life questionnaire was combined with the Visual Analogue Scale for assessment of pain. The Visual Analogue Scale is a visual scale of 100 mm, ranging from 0 (no pain) to 100 (pain as bad as it could be), which has been used for more than a quarter of a century. Although the Visual Analogue Scale quantifies the pain a patient experiences, this is only one of the factors of overall quality of life after surgery. Another contributing factor to the overall quality of life is the patients’ self-perception, examined by the Body Image Questionnaire. The Body Image Questionnaire has been used to assess how patients with incisional hernias perceive their body image, finding that body image scores are significantly lower in patients with incisional hernias compared with healthy persons.

In conclusion, there are several standardized methods for examining quality of life after incisional hernia repair, both generic and disease specific. Presently, however, no consensus on either the optimal method or timing of the measurement exists, calling for international guidelines on this topic, to enable comparison across the different studies. The authors of this review consider a combination of the existing methods ideal, providing a questionnaire assessing both disease-specific and generic aspects of quality of life. Thus a combination of Short-Form 36 and Hernia-Related Quality-of-Life Survey or Carolinas Comfort Scale presently should be the optimal method for quality of life assessment.

References