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Original Research Article

# Factors Affecting Return to Normal Physical Activity after Inguinal Hernia Surgery

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**Abstract**

**Background:** Recovery after inguinal hernia surgery varies according to patient, surgical, occupational, and postoperative factors. Identifying determinants of delayed recovery may improve counselling and postoperative care.

**Objective:** To assess factors affecting return to normal physical activity after elective inguinal hernia repair.

**Methods:** This prospective observational study included 107 adults undergoing open, transabdominal preperitoneal (TAPP), or totally extraperitoneal (TEP) repair at Government Medical College, Siddipet. Demographic, clinical, occupational, operative, pain, and postoperative data were collected. Return time was assessed during follow-up. Group comparisons, correlation analysis, and multiple linear regression were performed, with $p<0.05$ considered statistically significant.

**Results:** The mean time to resume normal physical activity was 11.04 ± 3.47 days; 94 patients (87.9%) returned within 14 days. Mean recovery time was longer after open repair (12.88 days) than after TAPP (9.16 days) or TEP (9.46 days; $p<0.001$). Heavy occupational work and postoperative complications were also associated with longer recovery ($p<0.001$). Postoperative pain correlated positively with return time ($r=0.329$, $p<0.001$). In adjusted analysis, postoperative pain, open repair, moderate or heavy work, postoperative complications, recurrent hernia, and bilateral hernia independently prolonged recovery. Age, body mass index, preoperative pain, and TAPP versus TEP were not significant predictors.

**Conclusion:** Most patients resumed normal activity within two weeks. Laparoscopic repair, effective pain control, prevention of complications, and occupation-specific postoperative advice may facilitate earlier functional recovery.

**Keywords:** Inguinal Hernia; Physical Activity; Postoperative Recovery; Laparoscopic Repair; Postoperative Pain; Occupational Workload.

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## Introduction

Inguinal hernia repair is one of the most commonly performed general surgical procedures worldwide. The principal objectives of surgery are to relieve symptoms, prevent complications and restore the patient's normal physical functioning. Open mesh repair and laparo-endoscopic techniques, such as TAPP and TEP, are widely used.

Modern surgical and anaesthetic techniques have enabled earlier mobilisation and faster recovery after surgery.[1,2] Return to normal physical activity includes the resumption of walking, climbing stairs, household work, driving, employment, exercise and other activities performed before surgery. International guidelines recommend that patients resume normal activities as soon as they feel comfortable.[1] However, recovery time differs considerably among patients. Postoperative pain and wound-related problems are among the main reasons for delayed return to work and leisure activities.[3] The return to physical activity may be affected by age, sex, body mass index, comorbidities, preoperative pain, postoperative pain, type of surgical repair, bilateral or recurrent hernia and postoperative complications.[1,4]

Occupational demands, particularly heavy lifting and prolonged standing, may further delay recovery.[5] Psychological factors, including anxiety, depression, fear of movement and expectations regarding recovery, may also

influence the time required to resume normal activities.[6] Identifying these factors can help surgeons provide individualized counselling, improve pain management and plan an appropriate postoperative recovery programme. Therefore, the present study aims to assess the factors affecting return to normal physical activity among patients undergoing inguinal hernia surgery.

## Materials and Methods

**Study Design:** A prospective observational study was conducted to identify the factors affecting return to normal physical activity after inguinal hernia surgery.

**Study Setting and Duration:** The study was carried out in the Department of General Surgery at Government Medical College, Siddipet for one year.

**Study Population:** The study population were consisting of adult patients undergoing elective open or laparoscopic inguinal hernia repair during the study period.

### Inclusion Criteria

- Patients aged 18 years and above.
- Patients undergoing elective primary or recurrent inguinal hernia repair.
- Patients undergoing open, TAPP or TEP repair.
- Patients willing to participate and provide written informed consent.
- Patients available for postoperative follow-up.

### Exclusion Criteria

- Patients undergoing emergency surgery for obstructed or strangulated hernia.
- Patients with femoral, incisional or other abdominal wall hernias.
- Patients undergoing another major surgical procedure simultaneously.
- Patients with severe physical disability or neurological disease affecting mobility.
- Patients who develop serious postoperative complications requiring prolonged hospitalization.
- Patients unwilling to participate or unavailable for follow-up.

**Sample Size and Sampling Technique:** The sample size was calculated using the formula:

$$n = \frac{Z^2P(1 - P}{ME^2}$$

Where p is the expected proportion of patients with delayed return to normal activity, dd is the allowable error and Zα/2=1.96 at the 95% confidence level. The minimum required sample size was 97 patients. After adding 10% to account for loss to follow-up: Therefore, the final sample size were rounded to 107 patients.

**Data-collection procedure:** After obtaining informed consent, information will be collected using a predesigned and pretested case-record form. Preoperative information will include age, sex, body mass index, smoking status, comorbidities, occupation, level of occupational physical activity, type and duration of hernia, primary or recurrent hernia, unilateral or bilateral involvement, preoperative pain and usual physical activity. Operative information will include the type of repair, open or laparoscopic approach, type of anaesthesia, mesh used, duration of surgery and intraoperative complications. Postoperative information was including pain intensity, analgesic requirement, and length of hospital stay, wound complications and other postoperative complications.

Pain was measured using the Numerical Rating Scale from 0 to 10, where 0 indicates no pain and 10 indicates the worst possible pain. Patients were followed on postoperative days 7, 14 and 30 and at three months through outpatient visits or telephone interviews.

**Outcome Assessment:** The primary outcome was the number of days from surgery until return to normal physical activity. Return to normal physical activity was defined as the patient's resumption of his or her usual preoperative activities, including independent walking, climbing stairs, household activities, driving, occupational work and routine exercise, without significant restriction caused by postoperative pain.

The factors evaluated were include:

- Age, sex and body mass index.
- Smoking and comorbidities.
- Preoperative pain and activity level.
- Type and complexity of hernia.
- Open or laparoscopic surgical approach.
- Duration of surgery and type of anaesthesia.
- Postoperative pain and analgesic requirement.
- Wound and postoperative complications.
- Occupation and requirement for heavy physical work.
- Patient expectations and postoperative advice.

**Statistical Analysis:** Data were entered into Microsoft Excel and analysed using SPSS 28. Categorical variables will be presented as frequencies and percentages. Continuous variables were expressed as mean with standard deviation or median with interquartile range, depending on their distribution. The independent-samples t-test or Mann–Whitney U test will be used to compare the time required to return to activity between two groups. ANOVA or the Kruskal–Wallis test was used for comparisons involving more than two

groups. Associations between categorical variables were evaluated using the chi-square test or Fisher's exact test.

Multivariable regression analysis was performed to identify independent factors associated with delayed return to normal physical activity.

A p-value below 0.05 was considered statistically significant.

**Ethical Considerations:** The study was begun after obtaining approval from the Institutional Ethics Committee. Written informed consent was obtained from every participant. Patient information was remained confidential, and participation in the study was voluntary.

**Observation and Results**

**Table 1: Demographic and clinical characteristics**

| Variable | Category | Number | Percentage |
|---|---|---|---|
| Sex | Male | 97 | 90.7 |
| | Female | 10 | 9.3 |
| Comorbidity | Present | 37 | 34.6 |
| | Absent | 70 | 65.4 |
| Hernia type | Primary | 96 | 89.7 |
| | Recurrent | 11 | 10.3 |
| Hernia involvement | Unilateral | 87 | 81.3 |
| | Bilateral | 20 | 18.7 |
| Surgical procedure | Open repair | 52 | 48.6 |
| | TAPP | 31 | 29 |
| | TEP | 24 | 22.4 |
| Occupational activity | Sedentary/light | 44 | 41.1 |
| | Moderate | 33 | 30.8 |
| | Heavy | 30 | 28 |
| Postoperative complications | Present | 16 | 15 |
| | Absent | 91 | 85 |

Among 107 patients, the majority were male (90.7%), had a primary hernia (89.7%) and unilateral involvement (81.3%). Open repair was performed in 48.6% of patients, followed by TAPP in 29.0% and TEP in 22.4%. Approximately 28.0% performed heavy occupational work, while postoperative complications occurred in 15.0% of patients.

**Table 2. Pain scores and return to normal physical activity**

| Parameter | Mean ± SD | Median | Range |
|---|---|---|---|
| Preoperative pain score | 3.63±1.623.63 | 3 | 0–8 |
| Early postoperative pain score | 3.67±1.263.67 | 4 | 1–8 |
| Time to return to normal activity | 11.04±3.47 | 11 days | 3–20 days |

The mean preoperative and early postoperative pain scores were 3.63±1.623.63\pm1.62 and 3.67±1.263.67\pm1.26, respectively. The mean time required to return to normal physical activity was 11.04±3.4711.04\pm3.47 days, with a median of 11 days and a range of 3–20 days.

**Table 3. Distribution according to return time**

| Return to activity | Number | Percentage |
|---|---|---|
| Within 14 days | 94 | 87.9 |
| More than 14 days | 13 | 12.1 |
| Total | 107 | 100 |

Of the 107 patients, 94 (87.9%) returned to normal physical activity within 14 days, whereas 13 (12.1%) required more than 14 days. Thus, most patients resumed their usual activities within two weeks of surgery.

**Table 4. Factors associated with time to return to normal activity**

| Factor | Category | n | Mean return time (days) | Test | p-value |
|---|---|---|---|---|---|
| Sex | Male | 97 | 11.08±3.47 | 0.396 | 0.7 |
| | Female | 10 | 10.60±3.69 | | |
| Comorbidity | Present | 37 | 10.81±3.49 | 0.489 | 0.626 |
| | Absent | 70 | 11.16±3.48 | | |
| Hernia type | Primary | 96 | 10.80±3.33 | 1.762 | 0.105 |
| | Recurrent | 11 | 13.09±4.16 | | |
| Hernia involvement | Unilateral | 87 | 10.70±3.35 | 1.992 | 0.057 |

| | | | | | |
|---|---|---|---|---|---|
| | Bilateral | 20 | 12.50±3.71 | | |
| Surgical procedure | Open repair | 52 | 12.88±2.79 | 19.338 | <0.001 |
| | TAPP | 31 | 9.16±2.98 | | |
| | TEP | 24 | 9.46±3.41 | | |
| Occupational activity | Sedentary/light | 44 | 9.48±3.55 | 11.56 | <0.001 |
| | Moderate | 33 | 11.27±2.88 | | |
| | Heavy | 30 | 13.07±2.86 | | |
| Postoperative complications | Present | 16 | 13.81±2.17 | 5.016 | <0.001 |
| | Absent | 91 | 10.55±3.44 | | |

The mean return time was significantly longer after open repair (12.88 days) than after TAPP (9.16 days) and TEP (9.46 days), with F=19.338 and p<0.001. Patients performing heavy work required 13.07 days, compared with 11.27 days for moderate work and 9.48 days for sedentary or light work (F=11.560, p<0.001). Patients with postoperative complications also required significantly more time than those without complications (13.81 versus 10.55 days; (t=5.016, p<0.001). Return time was not significantly associated with sex (p=0.700), comorbidity (p=0.626) or hernia type (p=0.105). Patients with bilateral hernia required more time than those with unilateral hernia, but the difference was marginally non-significant (12.50 versus 10.70 days; p=0.057).

**Table 5. Association between selected factors and delayed return beyond 14 days**

| Factor | Category | Delayed return, n (%) | p-value |
|---|---|---|---|
| Surgical procedure | Open repair | 12 (23.1) | 0.003 |
| | TAPP | 0 (0.0) | |
| | TEP | 1 (4.2) | |
| Occupational activity | Sedentary/light | 1 (2.3) | 0.02 |
| | Moderate | 5 (15.2) | |
| | Heavy | 7 (23.3) | |
| Hernia type | Primary | 9 (9.4) | 0.035 |
| | Recurrent | 4 (36.4) | |
| Hernia involvement | Unilateral | 9 (10.3) | 0.417 |
| | Bilateral | 4 (20.0) | |
| Postoperative complications | Absent | 10 (11.0) | 0.645 |
| | Present | 3 (18.8) | |
| Sex | Male | 12 (12.4) | 1 |
| | Female | 1 (10.0) | |

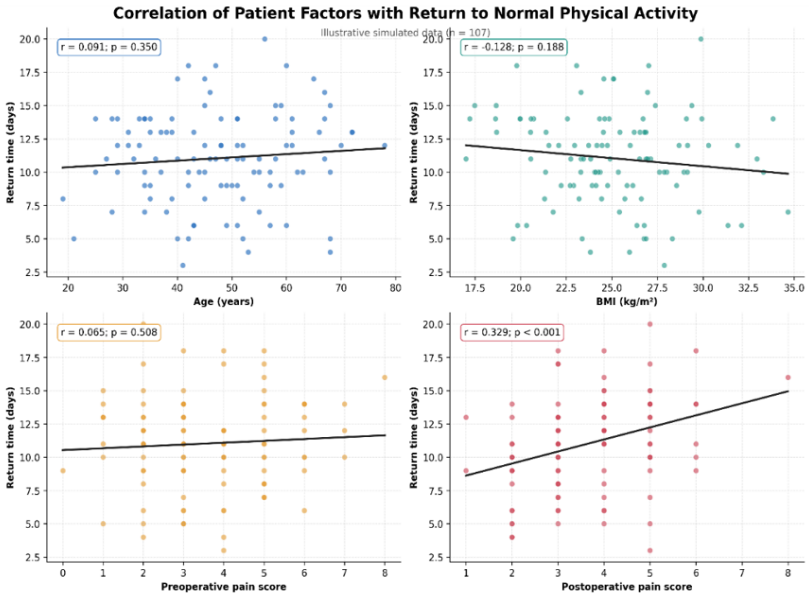


**Figure 1: Correlation with return-to-activity time**

Delayed return was significantly more common following open repair (23.1%) than TAPP (0%) or TEP repair (4.2%; p=0.003).

It was also more frequent among patients performing heavy work (23.3%) than those

performing moderate (15.2%) or sedentary/light work (2.3%; p=0.020).

Recurrent hernia was associated with a higher delayed-return rate than primary hernia (36.4% versus 9.4%; p=0.035). Delayed return was not significantly associated with hernia involvement (p=0.417), postoperative complications (p=0.645) or sex (p=1.000).

Postoperative pain showed a significant positive correlation with return time (r=0.329, p<0.001), indicating that patients with greater postoperative pain took longer to resume normal activity.

Age (r=0.091, p=0.350), BMI (r=−0.128, p=0.188) and preoperative pain (r=0.065, p=0.508) did not show significant correlations.

**Table 6: Multiple linear regression analysis of factors affecting return time**

| Predictor | Adjusted coefficient (days) | 95% CI | p-value |
|---|---|---|---|
| Age, per year | 0.023 | −0.006 to 0.052 | 0.116 |
| BMI, per kg/m² | −0.009 | −0.111 to 0.093 | 0.863 |
| Preoperative pain score | 0.19 | −0.070 to 0.450 | 0.15 |
| Postoperative pain score | 0.87 | 0.525 to 1.215 | <0.001 |
| Open repair versus TEP | 3.043 | 2.069 to 4.016 | <0.001 |
| TAPP versus TEP | 0.703 | −0.353 to 1.758 | 0.19 |
| Moderate work versus sedentary/light | 2.136 | 1.208 to 3.065 | <0.001 |
| Heavy work versus sedentary/light | 5.07 | 4.089 to 6.051 | <0.001 |
| Postoperative complication | 2.736 | 1.662 to 3.810 | <0.001 |
| Recurrent hernia | 1.905 | 0.656 to 3.154 | 0.003 |
| Bilateral hernia | 1.675 | 0.733 to 2.617 | 0.001 |

After controlling for other variables, every one-point increase in postoperative pain was associated with an additional 0.87 days to return to activity (p<0.001). Open repair delayed return by approximately 3.04 days compared with TEP (p<0.001). Moderate and heavy occupational work increased return time by approximately 2.14 and 5.07 days, respectively (p<0.001).

Postoperative complications increased recovery time by 2.74 days (p<0.001), while recurrent and bilateral hernias increased it by 1.91 and 1.68 days, respectively. Age, BMI, preoperative pain and TAPP compared with TEP were not significant independent predictors.

## Discussion

The present study evaluated factors affecting return to normal physical activity after inguinal hernia surgery among 107 patients. Most patients were male (90.7%), had a primary hernia (89.7%) and had unilateral involvement (81.3%). This male predominance is consistent with the established epidemiological pattern of inguinal hernia and with Indian clinical studies in which most patients undergoing inguinal hernia repair were men.[7–10]

The mean time required to return to normal physical activity was 11.04±3.47 days, and 87.9% of patients resumed their usual activities within 14 days. These findings indicate that most patients achieved satisfactory early functional recovery. However, recovery time differed significantly according to surgical technique, postoperative pain, occupational demands, postoperative complications and characteristics of the hernia.

**Influence of surgical technique:** Patients undergoing open repair required significantly more time to resume normal activity than those undergoing laparoscopic repair. The mean return time was 12.88 days following open repair, compared with 9.16 days after TAPP and 9.46 days after TEP repair (F=19.338, p<0.001). After adjustment for other variables, open repair delayed return by approximately 3.04 days compared with TEP repair.

These results are comparable with the Indian study by Reghunandanan et al., in which patients returned to normal activity after approximately 14.5 days following open repair and seven days following laparoscopic repair.[7] Similarly, Lal et al. conducted a randomized controlled trial in India and reported that TEP repair produced less early postoperative pain and an earlier return to work than open Lichtenstein repair.[8]

Shah et al. found that return to normal activity occurred significantly earlier after TEP repair than after open Lichtenstein repair—13.6±6.8 versus 19.8±4.6 days, respectively (p<0.001).[9] Although the recovery times in that study were longer than those observed in the present study, the direction of the association was similar. Differences may be related to the definition of normal activity, patient occupation, postoperative advice, analgesic protocols and institutional practices.

Raajeshwaren et al., in a large study conducted at JIPMER, Puducherry, reported that patients undergoing laparoscopic repair returned to normal activities significantly earlier than those undergoing open repair—six versus eight days.[10]

Their recovery period was shorter than that observed in the present study, but both studies support the functional advantage of laparoscopic repair. Smaller incisions, reduced tissue dissection and less injury to the inguinal region may contribute to lower pain and faster mobilisation following laparoscopic surgery.

There was no significant adjusted difference between TAPP and TEP in the present study (p=0.190p=0.190). This finding agrees with the prospective Indian study by Saini et al., involving 144 patients, which found that TAPP and TEP were comparable in terms of postoperative pain, hospital stay, complications and recurrence.[11] Therefore, the choice between TAPP and TEP may reasonably depend on hernia characteristics, the surgeon's experience and available resources.

**Postoperative pain and return to activity:** Postoperative pain was an important determinant of recovery. A significant positive correlation was observed between postoperative pain and return time ($r=0.329$, $p<0.001$). Multiple regression analysis showed that every one-point increase in postoperative pain score was associated with an additional 0.87 days before resuming normal activity.

This finding is consistent with Indian comparative studies demonstrating lower postoperative pain after laparoscopic repair. Lal et al. reported significantly lower early pain following TEP than open Lichtenstein repair.[8]

Varshney et al. also found that TEP repair was associated with lower postoperative pain and earlier return to normal activity than Lichtenstein mesh repair.[12 These findings suggest that adequate perioperative analgesia, minimal tissue handling and early pain assessment may promote faster mobilisation and functional recovery.

Preoperative pain was not significantly associated with return time in the present study (p=0.150) in the adjusted analysis). This may indicate that immediate postoperative pain has a more direct influence on early functional recovery than the pain experienced before surgery. However, differences in pain perception, analgesic use and psychological response should also be considered.

**Occupational physical activity:** Occupational workload had a significant influence on recovery. Patients performing sedentary or light work returned to activity after an average of 9.48 days, compared with 11.27 days among those performing moderate work and 13.07 days among those performing heavy work ($F=11.560$, $p<0.001$). Delayed return beyond 14 days occurred in 23.3% of patients performing heavy work, compared with only 2.3% of those engaged in sedentary or light work.

After adjustment, moderate work delayed return by approximately 2.14 days, while heavy work delayed it by 5.07 days compared with sedentary or light work. This is clinically reasonable because occupations involving lifting, prolonged standing, bending and strenuous movements place greater physical demands on the healing abdominal wall.

An Indian comparative study by Patel et al. similarly found that patients undergoing laparoscopic TEP repair returned to strenuous work approximately 20 days earlier than those undergoing open repair.[13] These findings demonstrate that postoperative advice should be individualized according to occupational requirements instead of recommending an identical recovery period for every patient.

**Postoperative complications:** Patients who developed postoperative complications required significantly more time to resume normal activity than those without complications—13.81 versus 10.55 days ($t=5.016$, $p<0.001$). In the adjusted analysis, a postoperative complication increased recovery time by approximately 2.74 days.

Complications such as seroma, scrotal oedema, wound infection, urinary retention and haematoma may increase pain, require additional treatment and reduce confidence in performing physical activity. Saini et al. reported scrotal oedema, seroma, ecchymosis and urinary retention as relevant complications following laparoscopic inguinal hernia repair.[11] Raajeshwaren et al. found surgical-site infection exclusively in the open-repair group, although other complication rates were broadly comparable between open and laparoscopic procedures.[10]

Postoperative complications were not significantly associated with the dichotomous outcome of return beyond 14 days in Table 5 (p=0.645), despite being significantly associated with the continuous number of recovery days. This apparent difference may have resulted from the small number of patients with complications and the loss of statistical information when recovery time was divided into only "within 14 days" and "more than 14 days."

**Hernia-related factors:** Patients with recurrent hernia took longer to resume normal activity than those with primary hernia—13.09 versus 10.80 days. Although the unadjusted difference was not statistically significant (p=0.105), recurrent hernia independently increased return time by approximately 1.91 days in the multivariable analysis (p=0.003). Delayed return beyond 14 days was also more common in recurrent than primary hernia cases (36.4% versus 9.4%, p=0.035).

Patients with bilateral hernia required an average of 12.50 days, compared with 10.70 days for

unilateral hernia. The unadjusted association was marginally non-significant (p=0.057); however, bilateral hernia independently increased recovery time by approximately 1.68 days after adjustment (p=0.001).

Recurrent and bilateral repairs may require greater dissection, longer operative manipulation and treatment of a larger anatomical area, which can delay recovery. Laparoscopic repair may nevertheless be particularly useful in bilateral and recurrent cases because both groins can be approached through the same small incisions.

**Other patient-related factors:** Age, sex, BMI and comorbidities were not significantly associated with return time. Age showed only a weak correlation with recovery time (r=0.091, p=0.350), while BMI showed a weak negative and non-significant correlation (r=−0.128, p=0.188). These results suggest that surgical and postoperative factors may have had a greater influence on early recovery than basic demographic characteristics. However, the absence of statistical significance should be interpreted carefully. Only 10 women were included, and relatively few patients had recurrent hernia, bilateral involvement or complications. The study may therefore have had insufficient statistical power to identify smaller associations within these subgroups.

## Conclusion

The study concluded that most patients returned to normal physical activity within 14 days after inguinal hernia surgery. Laparoscopic TAPP and TEP repairs were associated with earlier recovery than open repair. Higher postoperative pain, physically demanding work, postoperative complications, recurrent hernia and bilateral hernia significantly delayed return to normal activity. Therefore, appropriate selection of surgical technique, effective pain control, prevention of complications and individualized postoperative advice according to occupational demands may promote faster recovery.

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