

Factors Influencing Loss to Follow-up after Elective Inguinal Herniorrhaphy

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Objective: To identify risk factors associated with losses to follow-up after inguinal herniorrhaphy and to examine whether these factors are associated with higher risks for recurrence according to the literature.

Material and Method: Records of inguinal hernia patients who underwent elective inguinal herniorrhaphy between January 1998 and November 2006 were reviewed. Factors potentially associated with loss to follow-up included demographic variables, type of hernia, predisposing factors, type of anesthesia, surgeon experience, type of repair, and early operative complications. Loss to follow-up was defined as the absence of follow-up information three months after herniorrhaphy for at least two years.

Results: There were 1,451 patients with 1,727 hernia operations. Of these, 981 operations (57%) were lost to follow-up. On multivariable analysis, factors associated with loss to follow-up included younger age, male gender, secondary hernia, tissue-based repair, indirect inguinal hernia, and no postoperative complications. Many of these factors were not known to be associated with increased recurrence after hernia repair.

Conclusion: Hernia repairs lost to follow-up were systematically different from those not lost to follow-up, but factors related to these losses were not clearly or uniformly associated with higher risks for recurrence according to the literature.

Keywords: Inguinal herniorrhaphy, Loss to follow-up, Risk factors, Recurrence

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Patients who have undergone inguinal herniorrhaphy are sometimes lost to follow-up for unknown reasons. Some surgeons assumed that many patients lost to follow-up are often those with a higher risk of hernia recurrence⁽¹⁾, *i.e.*, those who are likely to have a recurrence and are reoperated on elsewhere. The objective of the present study was to identify factors significantly associated with the loss to follow-up and to examine whether these factors were consistently associated with higher risks of hernia recurrence according to the literature.

Material and Method

The authors reviewed the medical records of patients who underwent elective inguinal herniorrhaphy during the period between January 1998 and November 2006 at Ramathibodi Hospital. Patients or their operations were excluded if the

operative records were not available, if the operations were for femoral or other hernias, or for emergency conditions. The Hospital's Research Ethics Committee approved the present study.

The primary unit of analysis was the individual hernia, which could be located on the left or right side, or classified as primary or secondary and could occur in the same patient many times. Secondary or recurrent inguinal hernias were defined as the diagnosis of recurrent herniation at the site of a previous inguinal hernia repair. Risk factors for loss to follow-up included: demographic data, type of inguinal hernia, predisposing conditions, defect size, type of anesthesia, experience of the surgeon, type of repair, operative time, and early postoperative complications.

Hernia operations lost to follow-up were defined as those without known recurrent events and without follow-up information beyond three months after surgery, for at least two years. The justification for these numbers was that most initial follow-up appointments were within three months after surgery, and most recurrences due to technical errors would

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occur within two years⁽¹⁻³⁾, so it should be safe to assume that a patient not returning to the hospital beyond three months for at least two years would probably not be coming back at all, at least not for problems related to the repaired hernia.

Statistical analyses were performed using Stata version 9 (Stata Corp, College Station, TX, USA). The correlation between multiple losses to follow-up in a patient was taken into account using random effects logistic regression analysis or the marginal logistic regression analysis via the generalized estimating equations (GEE) approach with exchangeable correlation and robust “sandwich” variance estimators⁽⁴⁾. Statistical significance was defined as a two-sided p-value of 0.05 or less.

Results

One thousand four hundred fifty one patients underwent 1,727 hernia operations during the period of the present study. No patient in the present study was operated on less than two years before the last follow-up date in the data set (November 29, 2008). According to the authors’ definition, 981 operations (57%) were lost to follow-up. Baseline and clinical characteristics of patients and their hernias including treatment and follow-up time are presented in Table 1, and contrasted between those lost and those not lost to follow-up.

Hernia operations not lost to follow-up (number, 746) were followed for a median time of 1.1 years (range, 8 days to 11 years), with 93 reoperations

Table 1. Baseline characteristics of patients and their hernias (n = 1,727)

Characteristics	Patients not lost to F/U ^a (n = 746)	Patients lost to F/U ^a (n = 981)	p-value ^b
Male gender ^c	535/595 (90)	793/856 (93)	0.067
Age (years) at time of repair			
Mean (sd)	60.8 (15.0)	55.9 (17.1)	<0.001
Primary hernia	672 (90)	924 (94)	0.001
Predisposing conditions ^d	161 (22)	179 (18)	0.084
Right-sided hernia	424 (57)	513 (52)	0.056
Inguinal Hernia			
Indirect (Nyhus types 1&2)	505 (68)	755 (77)	<0.001
Direct only or with indirect type	240 (32)	226 (23)	
Defect size, largest diameter (cm)			
Mean (SD)	4.4 (2.9)	4.7 (2.9)	0.085
Hernia operation			
Bassini repair	423 (56.7)	682 (70)	<0.001
Other tissue repair	27 (4)	33 (3)	
Open mesh repair	218 (29)	221 (23)	
Laparoscopic mesh repair	58 (10)	45 (4)	
Anesthesia			
Local or regional	364 (49)	543 (56)	0.011
General	372 (51)	432 (44)	
Surgeon experience			
Trainee	336 (45)	537 (55)	<0.001
Staff	409 (55)	442 (45)	
Operative time (minutes)			
Mean (sd)	99.9 (44.3)	98.2 (40.0)	0.422
Follow-up time			
Median (range)	1.1 yrs (8 days to 11 yrs)	11 days (3 days to 3 mo)	<0.001
Early postoperative complications	86 (12)	60 (6)	<0.001

^a, All summaries are number (%) unless stated otherwise; ^b, p-values according to chi-square, unpaired t-test and ranksum test as appropriate; ^c, Total number of individual subjects is 1,415; ^d, Predisposing conditions included: benign prostatic hyperplasia, chronic obstructive pulmonary disease, chronic renal failure, cirrhosis, chronic asthma, and pulmonary tuberculosis
F/U = follow-up; mo = months

occurring during the follow-up. The reoperation rate was 17% at three years and 28% at five years, according to a time-to-event analysis to be reported in a separate publication. The reoperation rate can be used as a proxy for the recurrence rate⁽⁵⁾. There were no reoperation data for patients lost to follow-up.

From Table 1, it seemed that hernia repairs that were lost to follow-up were more likely to be those for indirect, primary hernias associated with younger patients, repaired using tissue-based methods under regional anesthesia performed by surgical trainees, with no postoperative complications. Tissue-based methods were mainly Bassini repairs, while mesh-based methods included both open and laparoscopic mesh repairs.

From multivariable analyses, the only significant and independent risk factors for loss to follow-up were younger age, male gender, recurrent hernia, tissue repair, indirect hernia and early complications. Both the random effects and marginal GEE logistic regression analyses produced comparable models. Table 2 shows the marginal model only.

Discussion

The authors are not aware of any previously published analysis of factors influencing the loss to follow-up after inguinal herniorrhaphy. The present study showed that there were factors significantly associated with the loss to follow-up, which were not necessarily associated with a higher risk of recurrence after hernia repair.

Older age at the time of herniorrhaphy has been generally shown to be associated with a higher risk of hernia recurrence, whether after repairs for primary or secondary hernias⁽⁶⁻⁹⁾. However, the risk of loss to follow-up was associated with younger, rather than older, age. Gender was not a consistent risk

factor for hernia recurrence⁽⁸⁻¹⁰⁾, but women might be at a higher risk for reoperations^(10,11). The association between the male gender and loss to follow-up was probably due to some reasons other than a higher risk of recurrence.

Secondary hernias were associated with a higher risk of loss to follow-up and a higher risk of hernia recurrence after repair⁽⁷⁻¹¹⁾. This finding might partly support the hypothesis that patients lost to follow-up might have a higher risk of recurrence as well. Similarly, tissue-based repairs were associated with a higher risk of loss to follow-up as well as a higher risk of recurrence^(1,9-12). This finding might also support the higher risk of recurrence-higher loss to follow-up hypothesis.

However, the last two factors associated with loss to follow-up in Table 2, indirect hernia and absence of early postoperative complications could not be explained by a higher risk of recurrence. Indirect hernias, at least hernias with purely indirect component, are usually associated with a lower, if not significant, risk of recurrence after hernia repair^(7,8) and the presence of complications might or might not be associated with a higher risk of recurrence^(7,9,10). For example, a hematoma or infectious complications after a hernia repair might be associated with a higher risk of recurrence^(2,13), while the presence of postoperative seroma or early postoperative groin pain might not.

The results of the present study did not support the hypothesis that the loss to follow-up was uniformly associated with or was a marker of a higher risk of recurrence after herniorrhaphy⁽¹⁾. In fact, the unsystematic or inconsistent nature of the risk factors for the loss to follow-up when viewed as a predictors for recurrence, suggested that the losses to follow-up were due to a multitude of unrelated causes, such as surgeons electing not to follow these patients,

Table 2. Marginal multiple logistic regression using the GEE approach and robust standard errors showing significant and independent risk factors for loss to follow-up (n = 1,727)

Factors	Odds ratio (95% confidence interval)	p-value
Age (per year increase)	0.99 (0.98 to 0.99)	<0.001
Male gender vs. female gender	1.75 (1.20 to 2.56)	0.004
Recurrent hernia vs. primary hernia	1.94 (1.25 to 2.99)	0.003
Mesh repair vs. tissue repair	0.68 (0.52 to 0.89)	0.005
Indirect hernia vs. direct hernia	1.41 (1.10 to 1.81)	0.007
Early postoperative complications vs. none	0.54 (0.37 to 0.77)	0.001

GEE = generalized estimating equation

inconvenience on the part of patients returning for a follow-up, or, in some instances, a new recurrence treated elsewhere. Nonetheless, these losses were probably not random⁽¹⁴⁾ since if this were true, there should be no significant factors associated with the loss to follow-up.

The present study might be useful for confirming that, in studies on recurrence risk after hernia repairs, a large number of losses to follow-up could potentially bias the results of such studies⁽³⁾. Unfortunately, it was not clear that the bias would result in higher or lower estimates of the true recurrence risk (*i.e.*, informative dropouts), or even if a bias existed at all (non-informative dropouts)⁽¹⁴⁾.

Future studies on this topic should focus on tracing patients lost to follow-up and at least administering questionnaires to these patients to find the precise reasons why they did not return for further follow-up, as well as to determine the current status of the hernia repair. The latter determination is important if we are to conclude, definitively, that the losses to follow-up are indeed informative. This may even require a request for the patient to return for a follow-up visit, such that a physical examination can be performed⁽¹⁾.

Conclusion

Factors associated with the loss to follow-up included younger age, the male gender, secondary hernia, tissue-based repair, indirect hernia and no postoperative complications. According to the literature, not all of these factors were known to be associated with higher risks of recurrence after herniorrhaphy. It could not be determined whether these systematic differences would bias the estimated risk of recurrence in patients not lost to follow-up and in which direction, when compared with the estimated risk in the case where no losses to follow-up occurred. Further studies must focus on tracing patients lost to follow-up to determine their true hernia status.

Potential conflicts of interest

None.

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ปัจจัยที่มีผลกระทบต่อการขาดการติดตามหลังผ่าตัดใส่เลนส์ขานีบแบบไม่จุกเงิน

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วัตถุประสงค์: เพื่อค้นหาปัจจัยที่มีผลกระทบต่อการขาดการติดตามหลังผ่าตัดใส่เลนส์ขานีบแบบไม่จุกเงิน และเพื่อศึกษาว่าปัจจัยเหล่านี้มีความสัมพันธ์กับความเสี่ยงต่อการเกิดใส่เลนส์ซ้ำหรือไม่ด้วยการทบทวนวรรณกรรม

วัสดุและวิธีการ: ได้ทบทวนวรรณกรรมเบี่ยงเบนของผู้ป่วยที่ได้รับการผ่าตัดใส่เลนส์ขานีบแบบไม่จุกเงินระหว่างเดือน มกราคม พ.ศ. 2541 ถึงเดือนพฤศจิกายน พ.ศ. 2549 ทำการศึกษาปัจจัยที่อาจส่งผลกระทบต่อการขาดการติดตามหลังผ่าตัด อันประกอบด้วย อายุ เพศ ประเภทของใส่เลนส์ ปัจจัยเสี่ยงต่าง ๆ ต่อการเกิดใส่เลนส์ ประเภทของการให้ยาระงับความรู้สึกระหว่างผ่าตัด ประสบการณ์ของศัลยแพทย์ วิธีผ่าตัด และผลแทรกซ้อนจากการผ่าตัด ได้นิยามว่า การขาดการติดตามหมายถึง การไม่มาตามแพทย์นัดหมายภายใน 3 เดือนหลังการผ่าตัด เป็นเวลาต่อเนื่องไม่น้อยกว่า 2 ปี

ผลการศึกษา: มีผู้ป่วยจำนวน 1,451 ราย ได้รับการผ่าตัดใส่เลนส์ 1,727 ครั้ง ในช่วงเวลาที่ศึกษา ในจำนวนนี้มี การผ่าตัด 981 ครั้ง (ร้อยละ 57) ที่ขาดการติดตาม เมื่อวิเคราะห์ข้อมูลโดยพิจารณาหลาย ๆ ปัจจัยพร้อมกันพบว่า ปัจจัยที่มีความสัมพันธ์กับการขาดการติดตามอย่างมีนัยสำคัญทางสถิติ ได้แก่ การมีอายุน้อย เป็นเพศชาย เป็นใส่เลนส์ ที่ปรากฏซ้ำหรือใส่เลนส์แบบ indirect ได้รับการผ่าตัดใส่เลนส์แบบเย็บขอบมธรรมดา และการไม่พบภาวะแทรกซ้อนหลังผ่าตัด ซึ่งปัจจัยเหล่านี้มีบางปัจจัยที่ไม่เกี่ยวข้องกับการเกิดใส่เลนส์ซ้ำ

สรุป: การผ่าตัดใส่เลนส์ที่ขาดการติดตาม มีความแตกต่างจากการผ่าตัดที่ได้รับการติดตาม แต่ปัจจัยที่สัมพันธ์กับการขาดการติดตามอาจไม่เพิ่มความเสี่ยงต่อการเกิดใส่เลนส์ซ้ำก็เป็นได้
