Planned Early Discharge–Elective Surgical Readmission Pathway for Patients With Gallstone Pancreatitis

Tatyan Clarke, MD; Helen Sohn, MD; Rebecca Kelso, MD; Mikael Petrosyan, MD; Shirin Towfigh, MD; Rodney Mason, MD, PhD

Hypothesis: We assessed outcomes in patients with gallstone pancreatitis (GSP) managed using a readmission pathway of discharge from the index admission with early readmission cholecystectomy and compared these with conventional management. We hypothesized that the pathway would decrease hospital length of stay (LOS).

Design: Prospective cohort study.

Setting: County-based academic center.

Patients: All patients admitted with GSP between June 1, 2005, and June 30, 2007. The control group consisted of patients from the year before the adoption of the readmission pathway. The pathway group patients were enrolled in the first year from its inception (July 1, 2006).

Main Outcome Measures: Overall LOS, time from admission until operation, and pathway failures.

Results: Of 252 patients with GSP, 144 were managed by conventional methods, and 108 were managed using the readmission pathway. The overall mean (SD) LOS was 8.5 (6.0) days in the control group and 5.9 (3.1) days in the pathway group (P < .001). The mean (SD) times to surgery were 6.6 (4.5) days in the control group and 22.7 (10.4) days in the pathway group (P = .01). This did not lead to significantly more treatment failures, with 34 (23.6%) in the control group and 33 (30.6%) in the pathway group (P = .21). There were 6.5% (7 of 108) unplanned readmissions for recurrent pancreatitis in the pathway group. Morbidity was otherwise similar in both groups.

Conclusion: Use of the readmission pathway’s early discharge protocol decreased overall LOS and in this study population was not associated with any increase in morbidity compared with conventional management.

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Figure 1. Simplified treatment algorithm used in the study.

### METHODS

#### STUDY DESIGN

The readmission pathway was initiated on July 1, 2006. Data were collected prospectively for 12 months following inception of the pathway. The matched control group was selected from the patients admitted during the 12 months before July 1, 2006. A comparison was made between the 2 groups.

### CONVENTIONAL TREATMENT VS THE READMISSION PATHWAY

All patients admitted with GSP were managed with supportive care. This included intravenous fluid, pain medication, and serial laboratory tests and physical examination until clinical resolution of pancreatitis, defined by normalizing laboratory values and resolution of pain. Before July 1, 2006, patients were then placed on the emergency OR waiting list to undergo cholecystectomy. These patients fell under our conventional management and comprised the control group. Beginning July 1, 2006, patients were placed on the readmission pathway, which consisted of discharge with planned elective outpatient cholecystectomy within 2 weeks. Preoperative anesthesia evaluation and surgical consent were obtained before discharge, as well as a signed release form emphasizing the importance of compliance. On the day of surgery, all patients underwent cholecystectomy with or without cholangiography (Figure 1).

The readmission pathway was a global management change instituted and agreed on by the department of surgery and hospital administration, including the Committee of Utilization Review and Quality Improvement. The study was approved by the University of Southern California Health Sciences Institutional Review Board.

### STUDY POPULATIONS

All patients admitted to the emergency surgery service with a diagnosis of GSP between June 1, 2005, and June 30, 2007, were included in the study. The control group consisted of patients admitted in the first 12 months who were managed using conventional methods. The pathway group consisted of patients admitted in the second 12 months starting with the inception of the readmission pathway.

All patients were initially seen with abdominal pain in the emergency department and were diagnosed as having pancreatitis, defined by elevation of lipase levels 3 times the normal level or higher. Biliary cause was confirmed by sonographic presence of gallstones. Patients with alcohol-induced pancreatitis or other nonbiliary causes were excluded. Patients with evidence of nonresolving common bile duct (CBD) obstruction underwent ERCP. Those who required emergent operative intervention for management of their biliopancreatic process were excluded from this study. Patients in the control group subsequently underwent cholecystectomy with or without intraoperative cholangiography during the index admission. Patients in the pathway group were discharged with preset appointments for elective cholecystectomy within 2 weeks of discharge. Intraoperative cholangiography was performed selectively in patients who had biochemical evidence of biliopancreatic obstruction.

### OUTCOME MEASURES

Demographics, management data, and outcomes were retrieved from a prospectively collected database. The primary outcome measure was overall LOS. This included inpatient days from the index admission and included the readmission in the pathway group. Secondary outcome measures included time from admission to surgery, treatment failures, and morbidity.

Failures of conventional management in the control group were delays to surgery beyond the index admission. Pathway failure was defined as deviation from the readmission pathway for any reason. These included patients who canceled or rescheduled their surgery, patients who never returned for surgery, and patients who were readmitted for recurrent pancreatitis before the scheduled surgery date.

### DATA ANALYSIS

Based on emergency surgery service data, the mean (SD) LOS was 8.4 (4.8) days before the start of the study. Therefore, we estimated that a sample size of 92 patients in each group would have 80% power to detect a 2-day reduction in LOS using 2-group t test with a 2-sided statistically significance level of $P < .05$.

### STATISTICAL ANALYSIS

Length of stay was compared between the 2 groups using analysis of covariance controlling for age, sex, and Ranson score. The estimated difference is presented with 95% confidence intervals. Unadjusted comparisons were made using the Mann-Whitney test. Continuous secondary outcomes were compared in similar analyses of covariance, while binary secondary outcomes were compared in logistic regression models controlling for the same variables.

### RESULTS

Our study followed up 252 patients diagnosed as having GSP after being seen the emergency department between June 1, 2005, and June 30, 2007. There were 144 patients in the control group and 108 patients in the pathway group, with median age of 41 years (age range, 20-81 years) and 35 years (age range, 19-67 years), respectively. Eighty-one percent (n=116) of the patients in the control group and 79.6% (n=86) of the patients in the pathway group were women. Only 2 patients, 1 in each group, had a Ranson score exceeding 3. The percentages of patients requiring ERCP were 12.5% (18 of 144) in the control group and 20.4% (22 of 108) in the pathway group ($P=.09$).
The overall mean (SD) LOS was 8.5 (6.0) days in the control group and 5.9 (3.1) days in the pathway group, which represents an overall mean decrease of 2.6 (95% confidence interval, 1.4-3.9) days (P < .001). Adjusting for age, sex, race/ethnicity, and Ranson score did not affect the mean decrease in LOS. The adjusted postoperative period showed a significant decrease in time to discharge in the pathway group (Figure 2).

The 144 patients in the control group were managed with supportive care until clinical resolution of pancreatitis. Of these, 110 (76.4%) then underwent cholecystectomy with or without intraoperative cholangiography during the index admission. The mean (SD) time to surgery in this subset of patients was 6.6 (4.5) days (Figure 3). The remaining 34 (23.6%) were discharged before surgery and were defined as treatment failures. The mean (SD) time to surgery among the treatment failures was 83 (69) days. Reasons for discharge without surgery included patient- and institution-related factors. Of 34 control group treatment failures, 19 never underwent cholecystectomy, and 15 had delays to surgery, 4 of which were institution related and 11 of which were patient related (Table). To our knowledge, none of these 34 treatment failures were initially seen with recurrent pancreatitis.

All 108 patients in the pathway group were discharged with an elective cholecystectomy scheduled. The mean (SD) time from the initial admission until readmission and scheduled elective cholecystectomy in the pathway group was 22.7 (10.4) days (Figure 3). Thirty-three of 108 (30.6%) did not receive surgery on their planned readmission date and were defined as treatment failures (Table). The mean (SD) time to surgery in the treatment failures in the pathway group was 28 (17) days. The 33 treatment failures included 16 patients who were unable to be contacted and never underwent cholecystectomy and 10 patients who had delays to surgery (6 of which were institution related and 4 of which were patient related); 7 patients were readmitted before the scheduled surgery for recurrent acute GSP. These 7 patients were seen with recurrence at a median of 14 days (range, 9-75 days) after the initial discharge.

Univariate and multivariate logistic regression analyses were performed for age, sex, days of pain, Ranson score, total bilirubin level, white blood cell count, and the presence of CBD stones. None of these variables predicted which patients in the readmission pathway would experience recurrence before their scheduled surgery date.

There were 4 complications (2.8%) in the control group and 5 complications (4.6%) in the pathway group. Complications included retained bile duct stones (n = 3), wound infection (n = 3), bleeding (n = 1), inadvertent enterotomy (n = 1), and bile duct injury (n = 1). There was no statistically significant difference observed between the morbidity rates of the 2 groups (P = .43), and there were no mortalities.

Acute pancreatitis occurs in 0.05% to 8.6% of patients with gallstone disease, and its incidence in the United States seems to be increasing. Although most episodes of GSP are mild, the morbidity and mortality associated with severe pancreatitis have influenced the ap-
approach to surgical management of all gallstone-related diseases.14,16-18 Because there are no clear predisposing factors predicting the outcome or severity of an attack, the initial treatment advocated for acute GSP is supportive care irrespective of the initial disease severity.16,18-20 Urgent endoscopic intervention or operative exploration is occasionally necessary in patients with sequelae from CBD obstruction.3,5,8,9,21 In our series, ERCP was used in 15.9% of the patients with GSP, which is similar to what has been reported in the literature.22 No operative CBD explorations were required in our study patients. Removal of the gallbladder remains the definitive management of cholelithiasis and its complications. For GSP, laparoscopic cholecystectomy with or without cholangiography is the procedure of choice and is advocated to be performed during the index admission once the acute phase of pancreatitis has resolved. This practice has been reported and supported by many authors and has been the practice at our institution.23-25

In urban areas and in the public hospital setting, the ability to provide safe and accessible health care is complicated by diminishing resources. The result is a push to decrease LOS. Some have attempted to accomplish this by performing cholecystectomy before the resolution of clinical pancreatitis.26 However, the literature presents conflicting data on this topic and is too inconsistent to support early cholecystectomy, particularly because the operation is nonemergent.12,27-29 The current standard is based on the premise that cholecystectomy is not a treatment for GSP, which is usually a self-limited disease. Rather, it is a preventative strategy to avoid recurrence and other complications associated with gallstones. The high incidence of biliary disease, particularly GSP, at our facility creates a mismatch between patient volume and OR availability, delaying definitive management beyond the clinical resolution of pancreatitis and prolonging the hospital stay. Early cholecystectomy would place further demands on an already burdened emergency OR. The mean LOS for our patients with GSP is 8 days, which is longer than the 5.5-day LOS benchmark set by our institution. In the control group, the mean time to surgery was 6.6 days, whereas the mean time to resolution of GSP was 4.2 days. We can assume that more than 2 days of hospital stay in the control group was due to shortage of emergency OR availability.

The readmission pathway was formulated and instituted based on the hypothesis that it would decrease overall LOS. Several studies7,10,22,28 assessed the safety of delayed cholecystectomy for GSP performed at times ranging from 4 to 12 weeks after the initial attack, with varied outcomes. The rates of preoperative recurrence in these series were reported to be as high as 61%, but the timing of cholecystectomy did not seem to affect morbidity.12,18,22,23,27-29 Among pathway patients, the rate of recurrent pancreatitis before planned cholecystectomy was 6.5% (7 of 108), and treatment failures and morbidity in general were comparable in type and frequency to those of controls. The divergence of our data from those of other series may be attributable to a shortened outpatient delay until surgery (median, 17 days). Rather than the 4 to 12 weeks described in previous studies, the pathway required scheduled cholecystectomy within 2 weeks of discharge. Following resolution of a patient’s pancreatitis, he or she was discharged to decrease inpatient days brought about by resource limitation, so that the remaining wait for OR availability occurred outside of the hospital. With this strategy, the overall LOS in our population was reduced by 2 days without an observed increase in the treatment failure rate or morbidity. Because these cholecystectomies were performed in an outpatient setting, postoperative LOS was also significantly shortened.

The recurrent episodes of GSP seen in our 7 patients were mild, and there were no morbidities within this subset, although this did not account for additional pain, inconvenience, visits to the emergency department, or a second admission. Unaddressed by our study is the possible social morbidity of being away from home. The percentage of patients in the control group who requested discharge before cholecystectomy was 73.3% (11 of 15), which was greater than the relative number of patient-related delays observed in the pathway group (40.0% [4 of 10]), although the difference was not statistically significant (P = .10). This implies that patients may prefer the outpatient aspect of the pathway, but a patient satisfaction survey would be needed to confirm this.

There were several other limitations to this study. Our patient cohort with GSP was 92.9% Hispanic, with characteristics of mild pancreatitis and low Ranson scores.30 Although there have been reports about the safety of delayed surgery for severe pancreatitis, we have been unable to apply the pathway to these patients because of our homogeneous patient population.12,28 Although a low prevalence of severe disease prevented a formal assessment, there is no reason to expect that the pathway would be unsafe among this subgroup. However, patients with severe pancreatitis would have an inherently prolonged LOS, which belies the purpose of the readmission pathway. Decreased LOS usually means reduced costs, but formal analysis would be necessary to verify this.

We reviewed the safety of a clinical pathway of delayed cholecystectomy and its effect on outcome in the management of patients with GSP. When outpatient surgery can be scheduled with shorter delay, recurrence may be minimized. A randomized controlled study would need to be performed to test the efficacy of the readmission pathway as a management tool. The pathway was associated with improvements in overall LOS, an important outcome of care for patients with GSP at our facility. This has implications for the implementation of readmission pathways across a broad spectrum of surgical conditions and patient groups.

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Correspondence: Rodney Mason, MD, PhD, Division of Emergency Surgery, Department of Surgery, Keck School of Medicine of the University of Southern California and Los Angeles County—USC Medical Center, 1200 N State St, Ste 10830, Los Angeles, CA 90033 (rmason@surgery.usc.edu).

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Sherry Wren, MD, Palo Alto, California: The timing of surgery after mild pancreatitis has been debated by multiple authors and studies with a scarcity of true evidence-based medical guidelines to direct our practice in this area. The most common practice is to do a cholecystectomy in the same admission after normalization of abdominal tenderness with or without laboratory value normalization. This usually translates into an in-hospital stay of 5 or more days. This specific study takes place in a large urban public city hospital with resource allocation issues that may not be applicable in other hospital systems. The authors compared 2 pathways in the treatment of mild GSP and looked at the effect on overall LOS, recurrent disease, and the number of patients lost to follow-up. The hypothesis of the study was that commitment to an early readmit protocol, defined as cholecystectomy within 14 days of discharge, would diminish the overall total LOS in their hospital.

The study is called a prospective controlled study, where the 2 data points are the 12 months before and after the introduction of the pathway. It does not explicitly specify, but it appears that the control group cannot quite be considered a true control since these are retrospective data gathered from the preceding year. Unfortunately, LOS can be affected by multiple factors such as simply informing staff that not only is it being measured but that the hospital is trying to reduce it. I am curious why the study did not pick a true control group where staff knew that a lower LOS was a desirable variable. This study may be better described as a cohort study with a retrospective and prospective component.

The study results then demonstrate that the early readmit pathway has a shorter overall LOS. The mean LOS in the control group was 8.5 days compared with 5.9 days in the pathway group. When the 2 groups are compared, one of the first questions is why did the controls have an average of over 2 days of hospitalization after surgery? This is unusual for a group of healthy patients with mild GSP. If patients had been discharged in a more typical fashion such as same day or the next morning, this would have made the overall total LOS between the control and prospective groups almost equivalent. It is also interesting that the pathway was defined as readmission within 14 days for cholecystectomy and failure was defined as deviation from the pathway for any reason. If that definition had then been applied to the surgical cases it looks like the control group could not quite be considered a true control group. If the definition of failure was changed to readmission within 14 days for cholecystectomy and failure was defined as deviation from the pathway for any reason, it might have made a difference for the overall LOS.
days. Why did the authors not consider these patients treatment failures as defined in their “Methods” section? Based on the data, the readmit pathway would be more accurately described as readmission within 1 month instead of 2 weeks.

Overall, this article describes a unique approach taken at a public hospital to try and control the LOS in this patient population and to achieve a benchmark of 5.5 days. What the applicability of this pathway is outside of their unique health delivery environment is unclear. This approach is an interesting counterpoint to the approach taken by Bruce Stabile’s group at another Los Angeles County Hospital. In their 2007 article, they compared a prospective group of 43 similar patients with mild GSP to a retrospective control group. Their approach was to perform a cholecystectomy within 48 hours of admission. Their average LOS in the conventionally managed group was 7 days and only 4 days in the experimental group. Morbidity and mortality were no different. Can the authors discuss why they chose such a different pathway? The readmit pathway requires patients to re-present for surgery after discharge. In addition, patients had delays in treatment, with 7 requiring readmission for recurrent pancreatitis, 16 individuals never received an operation, and 10 other patients had a delay in operation, some waiting more than 30 days. Would resource allocation be best served by placing these healthy patients with mild GSP on the OR list just after admission and saving the need to re-present at that later date for surgery, which can be complicated by cancellations, no-shows, and recurrent disease? If your group is planning a prospective trial, I hope that both of these treatment algorithms would be studied in a rigorous fashion.

Dr Mason: I concur with Dr Wren’s comments that our hospital is unique in that our OR availability, the patients, and the situations are probably not comparable to other hospitals in the rest of the country. The first question was regarding whether the control patients were true controls. It is true that the patients were not true controls, as they were prospectively followed in the year preceding the pathway, and as such this is a cohort study.

As far as the postoperative LOS, it is true the patients post-operatively in the control group should have been discharged on the day of surgery, and yet many were not. This is related to a philosophy that the hospital and residents have in that the patients treated as outpatients tend to have a planned and expected early discharge, whereas the patients who are already in-house tend to have a less well-defined discharge plan. It is possible that if the patients in the control group were discharged on the same day of surgery as the comparable outpatient cholecystectomy patients, it most probably would decrease the LOS and not make the difference as significant.

As far as the readmit pathway, in our “Methods” section we state that the patient should be admitted within 14 days of discharge, and if you look at the article, the true readmittance was actually about 3 weeks after discharge. The policy of the readmit pathway as outlined in the “Methods” section was to have the patients readmitted within 14 days. This was done purposely to instill a sense of urgency such that patients were not waiting longer than 4 weeks, when we would expect the recurrence rate to increase. However, you can see that even using this as a rule, very few patients were actually scheduled within 14 days of discharge. So, Dr Wren is right; it is a readmission within 1 month.

You will notice that most of the recurrences did occur at about 10 days to 3 weeks, so I suppose the ideal would be to readmit these patients within 1 week of discharge. Another option is to do what Dr Stabile and his group have done, and that is to do the surgery as an emergency or schedule them as soon as they come in. The trouble is that does not alleviate OR availability, which is the main problem at our hospital. Furthermore, if we perform the surgery on admission or as soon as possible, the same admitting team most probably will not do the surgery, and this would generate multiple patient handoffs. I also think that part of the satisfaction of patients with the pathway was that they had the same group of surgeons who admitted them doing their cholecystectomy. I do not know if patients would be as satisfied if operated on by someone else other than the surgeons from the original admitting team.

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