

Outcome of Using Clinical Pathway in Laparoscopic Appendicectomy Patients – A Retrograde Analysis

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Abstract

Introduction: Appendicitis is a very common illness affecting all age groups of patients. It is the most common abdominal emergency. Open appendicectomy is a traditional method with its attendant complications. With the advent of laparoscopic surgeries, a laparoscopic appendicectomy has become one of the most common performed surgeries today. In many parts of the world, laparoscopic appendicectomy is a day care procedure.

Aim: To compare the efficacy of the pathway in appendicitis management in view of hospital stay, readmission rate, and complication rate.

Materials and Methods: A retrospective study was conducted in Sri Ramachandra University patients from 2008 to 2013. Comparison between the pathway group (2011-2013) and non-pathway (2008-2010) group was done. The duration of the hospital stay, complication rates, and readmission rate was compared between these two groups. In total of 893 patients, no clinical pathway was applied in 444 numbers of patients and pathway was applied 449 numbers of patients. Based on intraoperative findings both group patients are divided into appendicitis with peritonitis and appendicitis without peritonitis.

Results: The comparison between no pathway and pathway groups in the hours of hospital stay duration of appendicitis without peritonitis shows the statistical significance. The comparison between no pathway and pathway groups in the hours of hospital stay duration of with peritonitis shows no statistical significance. There was no difference in view of readmission rate and complication rate in both groups.

Conclusion: A standardized clinical pathway for simple appendicitis without peritonitis is very useful to reduce the duration of hospital stay without increase in readmission rate and complication rate. It gives favorable results on patient's outcome, hospital cost, and professional practice. Further modification of clinical pathway is essential to apply this in appendicitis with peritonitis patients to improve the outcome.

Key words: Appendicectomy, Clinical pathway, Laparoscopic appendicectomy

INTRODUCTION

Appendicitis is a very common illness affecting all age groups of patients. It is the most common abdominal emergency. The lifetime risk of developing appendicitis is approximately 7% with the highest frequency occurring at the ages from 10 to 30 years and usually requires surgical

treatment.¹ The overall incidence of this condition is approximately 11 cases a 10,000 populations a year. The overall lifetime risk is 8.6% for males and 6.7% for females.² Open appendicectomy is a traditional method with its attendant complications. With the advent of laparoscopic surgeries, a laparoscopic appendicectomy has become one of the most common performed surgeries today. It has significant advantages in terms of less post-operative pain and early return to home. In many parts of the world, laparoscopic appendicectomy is a day care procedure. Hence, this has been selected for a clinical pathway to achieve our goal of making it a day care procedure. As a surgeon, it is very important to participate in the development of clinical pathways and

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clinical guidelines.³ In 1998, the Southwestern Surgical Congress and the Southeastern Surgical Congress decided to publish the importance and efficacy of pathways in view of reducing length of stay and reducing the expenses for diagnosis. The practical guidelines, the motivation, the benefit and hazards of clinical pathways were analyzed by these surgical congresses.⁴ In critical care patients, implementation of clinical pathways significantly improved the care processes with a good collaboration of healthcare professionals without any rise in the readmission rate.⁵ There is significant improvement in length of stay, complication rate and financial outcomes in cancer patient by using evidence-based guidelines and clinical pathways.⁶ The critical pathway for the management of acute heart failure provides computerized order sets that guide health care providers through accepted treatment regimens, providing documentation of treatment and assists with compliance data collection.⁷ Pathway implementation in general surgery patients made a promising improvement in hospital care and patient satisfaction. Even though there are many clinical pathways used in clinical practice, pathway application for single surgical condition is rare. Since appendicitis is one of the commonest surgical emergencies in our practice, the pathway was applied for this condition in our hospital. Our aim is to compare the efficacy of the pathway in appendicitis management in view of hospital stay, readmission rate, and complication rate.

MATERIALS AND METHODS

This is a retrospective study conducted in Sri Ramachandra University patients from 2008 to 2013. All laparoscopic appendicectomy patients' details were collected from 2008 to 2010. There was no clinical pathway applied for laparoscopic appendicectomy patients in this period. From 2011 to 2013, all appendicectomy patients were treated with the clinical pathway. The exclusion criteria were open appendicectomy, laparoscopic appendicectomy converted to open, incidental appendicectomy, patients with symptoms that require intensive care unit (ICU) level of care, abscess appropriate for percutaneous drainage and initial non-operative treatment (intervention antibiotics, followed by interval appendectomy). After excluding these patients, only laparoscopically completed patients in this time period were selected for the study. Comparison between this pathway and non-pathway groups was done. The duration of the hospital stay, complication rates, and readmission rate was compared between these two groups.

Based on intraoperative findings, both group patients are divided into appendicitis with peritonitis and appendicitis without peritonitis.

In all patients, details like age, sex and diabetic status were collected. The duration of hospital stay was calculated in hours for every patient based on time of admission and time of discharge in the electronic record. The post-operative complications, such as wound infection, subacute intestinal obstruction, pelvic abscess, fecal fistula, and re-exploration rate, were collected from the case record. The readmission of patient within 1-month of post-operative period was collected from electronic records by using hospital admission number. The collected data were compared in both groups of patients.

Details of Clinical Pathway for Appendicectomy

Once patient was received in emergency department, emergency medical officer will assess the patient. If patient is provisionally diagnosed with appendicitis, pathway will be initiated. According to the pathway in Table 1, patient will be evaluated, and treatment will be started. Surgical consultant opinion should be obtained to all patients. Gynecologist opinion must be obtained for all female patients. The exclusion criteria for pathway are mentioned in Table 1. During the period of treatment if patient need higher level of care like ICU, prolonged nil per oral with parenteral therapy or if there is change in diagnosis intraoperatively, the patient will be excluded from the pathway. Patients undergo laparoscopic appendicectomy in the standard technique. Those who require conversion were excluded from the study. Pathway patients are divided into two groups based on intraoperative findings as, patients with peritonitis and patients without peritonitis. Antibiotics guideline was followed for both groups of patients. For patients without peritonitis, discharge planning will start on post-operative day (POD) 1 and most of them will be discharged on POD 2. If patient develops post-operative complications consultant can upgrade antibiotics if indicated and the reason for upgrading antibiotics must be documented in the case record. Patients with appendicitis with peritonitis are discharged on POD 4 and patients with abscess needing drain placement are discharged on POD 7.

Statistical Methods

The collected data were analyzed with SPSS for windows, version 16.0, Chicago Inc. To describe about the data descriptive statistics mean and standard deviation (SD) were used for continuous variables. To find the significant difference between the bivariate samples in Independent groups the unpaired sample *t*-test was used. In the above statistical tool, the $P < 0.05$ is considered as significant level.

RESULTS

A total of 893 patients were operated successfully with laparoscopic appendicectomy for the period of 6 years

Table 1: Appendicectomy pathway used in Sri Ramachandra Medical University (from 2011 to 2013)

		Day of surgery				
		1 st POD	2 nd POD (end of pathway for AC. appendicitis without peritonitis)	3 rd POD	4 th POD (end of pathway for appendicitis with peritonitis)	5 th POD
Phase of care	Emergency room/admission/preoperative					
Consults	(a) Surgical consult for abdominal pain (b) Gynecology opinion for a female patient					
Lab/tests	CBC, TC, DC urine analysis. If dehydrated, to do RFT, serum electrolytes. If diffusely tender abdomen, serum amylase. Urine pregnancy test	If still NPO, repeat RFT, serum electrolytes				
Radiology	Acute abdominal series (X-ray, USG-abdomen) as requested by concerned surgeon	CBC, TC, DC if febrile (38°C) or WBC or not tolerating diet				
Treatments	Insert IV	If febrile >38°C and WBC >14,000, CT of abdomen Any abscess is drained				
Medication	IV antibiotics cefazolin, metrogl or clindamycin	D/C IV antibiotics, if afebrile, tolerating diet WBC – (N) Start oral antibiotics Paracetamol, codeine				
Pain management	Comfort measures	Oral antibiotics				
Nutrition/hydration	NPO Start IV fluids DNS/NS/RL	Analgesics IV/IM (A) IV fluids (B) D/C IV after antibiotics Liquid diet (N) Diet				
Activity	Ad lib/As tolerated	Soft solid diet				
Assessment and monitoring	Physical vital signs Fluid monitoring Pain scoring	Ambulate Pain scoring Vital signs Monitoring				
Patient/family teaching	Explain diagnostic studies Provide patient/family with a copy of the Appendicitis/Appendectomy Teaching Handout Consent: Surgery consent for "Appendectomy" to be obtained after the surgeon/surgical resident has talked to the patient/family	Ambulate Pain scoring Vital signs Monitoring Discharge planning Explain discharge criteria appointment for follow-up				

(Contd...)

Table 1: (Continued)

Phase of care	Emergency room/admission/ preoperative	Day of surgery	1 st POD	2 nd POD (end of pathway for AC: appendicitis without peritonitis)	3 rd POD	4 th POD (end of pathway for appendicitis with peritonitis)	5 th POD
Other	If obstructed NG tube If dehydrated IV fluids and/or Foley catheter	Intraoperative protocol	Remove NG when BS+drainage less, Abd not bloated, Patient hungry. Remove Foley				
Expected outcome	No other X-rays or lab	No intraoperative complications compliance with Intraoperative protocol		(B) Discharge	(A) Afebrile (N) WBC	(A) Discharge	Discharge by day 7

TPN: Total parenteral nutrition, ICU: Intensive care unit, IV: Intravenous, POD: Post-operative day, CBC: Complete blood count, TC: Total count, DC: Differential count, RFT: Renal function test, WBC: White blood cell, USG: Ultrasonography, CT: Computed tomography, NS: Normal saline, RL: Ringer's lactate, IM: Intramuscular, NPO: Nil per oral

in Sri Ramachandra University (2008-2013). From 2008 to 2010, a number of patients operated with laparoscopic appendicectomy are 444 in which no clinical pathway was applied. However, pathway was applied from 2011 to 2013 for totally 449 numbers of patients. On comparing the age of the patients, the mean age in pathway and non-pathway groups are almost equal (30.36 ± 13.9 and 30.21 ± 12.6). The mean age of patients in appendicitis without peritonitis cases is significantly lesser (in pathway 29.22 ± 11.3 and no pathway 27.73 ± 12.3) than peritonitis cases (in pathway 34.48 ± 15.8 and in no pathway 38.32 ± 15.8). The male:female ratio of appendicitis patients is 1.2:1 (481 and 412, respectively). In total, 893 patients appendicitis with peritonitis is 201 (22.5%) and without peritonitis are 692 (77.4%). In total, 201 peritonitis patients 111 (55.2%) patients are female patients and 90 (44.8%) patients are male patients. A number of patients with diabetic mellitus are 147 (16.5%). The diabetic status is significantly high in appendicitis with peritonitis patients (35.8% - 72/201) than appendicitis without peritonitis (10.8% - 75/692) (Table 2).

The comparison between no pathway and pathway groups in the hours of hospital stay duration shows a statistical significance ($P = 0.0005 < 0.01$) with the mean \pm SD of the no pathway group (102.8 ± 35.0) and pathway group (90.6 ± 41.0) (Table 3 and Graph 1).

The comparison between no pathway and pathway groups in the hours of hospital stay duration of appendicitis without peritonitis shows a statistical significance ($P = 0.0005 < 0.01$) with the mean \pm SD of the No pathway group (87.6 ± 23) and pathway group (72.8 ± 22.4). It was shown in Graph 2.

The comparison between no pathway and pathway groups in the hours of hospital stay duration of with peritonitis shows no statistical significance ($P = 0.462 > 0.05$) with

Table 2: Comparison of duration of hospital stay in total pathway and no pathway group

Groups	Mean	SD	P value
No pathway	102.8	35.9	0.0005**
Pathway	90.6	41.0	

**Highly significant at $P < 0.01$ level. SD: Standard deviation

Table 3: Comparison of hospital stay in hours

Variables	Groups	Mean	SD	P value
Without peritonitis	No pathway	87.6	23.0	0.0005**
	Pathway	72.8	22.4	
With peritonitis	No pathway	152.6	23.2	0.462#
	Pathway	155.1	25.5	

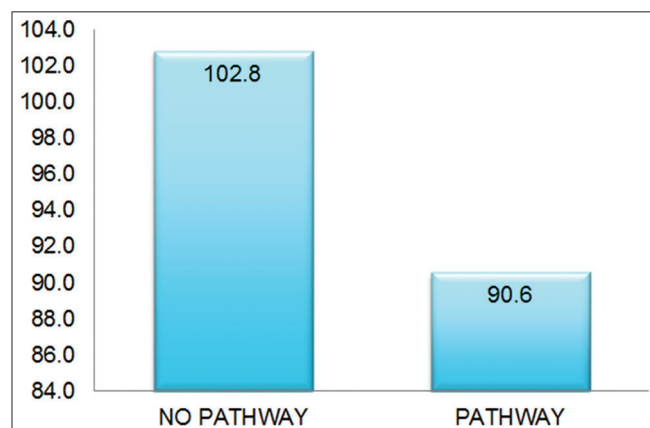
Pathway group without peritonitis versus No pathway group without peritonitis.

Pathway group with peritonitis versus No pathway group with peritonitis.

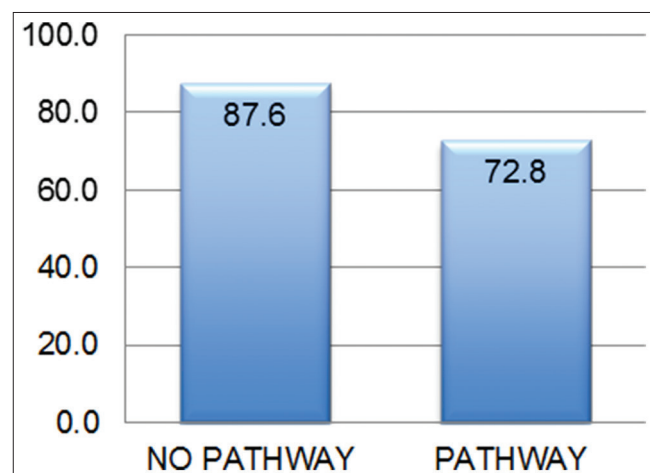
**Highly significant at $P < 0.01$ level, #No significance. SD: Standard deviation

the mean \pm SD of the No pathway group (151.6 \pm 23.2) and pathway group (155.1 \pm 25.5) (Table 4).

Regarding post-operative complications, 22 patients (2.4%) had complications. The complication rate in pathway group is 2% (9 patients) and non-pathway group is 2.92% (13 patients). In appendicitis without peritonitis cases, only complication recorded is wound infection 0.1% (7 patients)



Graph 1: Comparison of duration of hospital stay in pathway and no pathway group



Graph 2: Duration of hospital stay in appendicitis without peritonitis

and there is no readmission and re-exploration found in this group. Wound infection rate in pathway group without peritonitis is 3 patients and in no pathway group without peritonitis is 4 patients. Hence, there is no difference in this group. But in appendicitis with peritonitis, the complication rate is 7.4% (15 patients). In pathway group, it is 6.2% and in non-pathway group it is 9.7%. It is again not statistically significant. The readmission rate in pathway group is 6.2% and in non-pathway group is 6.7%. The re-exploration rate in pathway and non-pathway group is 1% and 1.9%, respectively.

DISCUSSION

Acute appendicitis is one of the most common surgical emergencies in humans. Laparoscopic appendicectomy is the standard of care in these cases. However, there is a considerable variability in the diagnosis and management protocols across consultants. Clinical pathways have been able to bridge these gaps and provide significant improvement in clinical care in surgery.⁸ Again pathways produce better teamwork and hence very useful in health organizations.⁹ Clinical pathways in acute appendicitis are a common practice in many pediatric hospitals.¹⁰⁻¹³ As part of quality improvement, pathway for acute appendicitis was introduced in our hospital in 2011. This 6-year retrospective analysis has given a lot of insight into the usefulness of a clinical pathway. One of the major advantages we were able to derive was the reduced hospital stay, which was on an average 12 h lesser after the introduction of the pathway, and this was statistically significant. Emil *et al.*,¹⁰ Warner *et al.*¹¹ and Kenji Takegami *et al.*¹⁴ have also brought out this significant advantage in their studies. The pathway could significantly reduce the hospital stay only in the group without peritonitis; there was no significant difference in the length of hospital stay in the group with peritonitis, similar to the study by Emil *et al.*¹⁰ The complication, re-admission and re-exploration rates were similar in both the groups in our study. But the readmission rate was found to be significantly lesser in the pathway group by Emil. Drain

Table 4: Comparison of complication rate, re-admission rate and re-exploration rate

Post operative problems	Pathway (%)	No pathway (%)	Without peritonitis (%)		With peritonitis (%)	
			Pathway	No pathway	Pathway	No pathway
Complications						
Wound infection	7 (1.6)	8 (1.8)	3 (0.9)	4 (1.2)	4 (4.1)	4 (3.8)
Pelvic abscess	1 (0.2)	3 (0.7)	0	0	1 (1)	3 (2.9)
Subacute intestinal obstruction	0	1 (0.2)	0	0	0	1 (1)
Wound infection with pelvic abscess	1 (0.2)	0	0	0	1 (1)	0
Faecal fistula	0	1 (0.2)	0	0	0	1 (1)
Total	9 (2)	13 (2.9)	3 (0.9)	4 (1.2)	6 (6.2)	9 (9.7)
Readmission	6 (1.3)	7 (1.6)	0	0	6 (6.2)	7 (6.7)
Re-exploration	1 (0.2)	2 (0.5)	0	0	1 (1)	2 (1.9)

placement in patients with complicated appendicitis was significantly lesser in the pathway group in this study.¹⁰ Other major advantages brought out by other studies are lesser antibiotic usage, decreased hospital charges, fewer unnecessary laboratory tests and decreased surgical site infections.^{10-12,14,15} Clinical pathways are also a means of auditing surgical care and institute necessary modifications for the betterment of patient outcome.¹⁵

CONCLUSION

The results of the evaluation study show that a standardized clinical pathway for simple appendicitis without peritonitis is very useful to reduce the duration of hospital stay without increase in readmission rate and complication rate. It gives favorable results on patient's outcome, hospital cost, and professional practice. Further modification of clinical pathway is essential to apply this in appendicitis with peritonitis patients to improve the outcome.

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