



A PROSPECTIVE STUDY OF LAPAROSCOPIC APPENDICECTOMY FOR ACUTE APPENDICITIS AND ITS EARLY COMPLICATIONS

Surgery

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ABSTRACT

Introduction: laparoscopic appendectomy is one the most frequently performed surgical procedure worldwide. Since the frequency of the procedure is quite high thus related complications are also there. In this study a prospective study of laparoscopic appendectomy for acute appendicitis is done and statistics is performed for its related complications. **Material and method:** prospective comparative study on sample size of 100. **Results:** Laparoscopic procedure is associated with fewer cases of post operative wound infection (p value 0.002) and fecolith spillage (p value 0.006). Laparoscopic procedure has some distinct advantages (p value < 0.001) during the operation of the perforated appendix. The placement of the abdominal drain can be done under direct vision in the dependent part of the peritoneal cavity during laparoscopic surgery in much easier way (p value < 0.001). **Conclusion:** laparoscopic appendectomy in acute appendicitis and its early complications are associated with fewer per operative and early and late post operative complications. Furthermore, the return of the patients to normal work is much early and the cosmetic outcome is good in laparoscopic appendectomy.

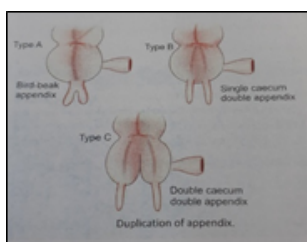
KEYWORDS

Laparoscopic appendectomy, acute appendicitis.

INTRODUCTION

Appendicectomy as the treatment for acute appendicitis and its various complications is one of the most frequently performed surgical procedures. Appendicectomy can be performed by various methods, namely open Appendicectomy, conventional appendicectomy, laparoscopic appendicectomy, transvaginal appendicectomy and single incision appendicectomy (SILS) .The term appendicitis was coined by REGINALD FITZ OF BOSTON in 1886. The peak incidence of appendicitis is between age 10 -30 years. Intake of less fibre diet increases the chances of appendicitis. The diagnosis of acute appendicitis is an elusive one and a high index of suspicion should be kept in mind so that the complications of acute appendicitis can be avoided, because appendicular perforation is one of its main complications and is a leading cause of morbidity. Acute appendicitis is mainly caused by obstruction of its lumen, which is caused by inspissated stool (faecolith or appendicolith), lymphoid hyperplasia, vegetable matter, seeds, parasites and neoplasm. Obstruction of the appendicular lumen will lead to the bacterial overgrowth and secretions within the lumen will produce distension with raised intraluminal pressure subsequently impairing the lymphatic and venous drainage leading to mucosa ischemia. This process will generate a localised inflammatory process which may culminate in gangrene, lump, perforation or appendicular abscess. Alternatively, greater omentum and the loops of small bowel may become adherent to the inflamed appendix, preventing the spread of peritoneal contamination resulting in a phlegmonous mass called appendicular mass or lump. These patients are managed mostly by open surgery at Emergency OT, leading to increased postoperative pain, wound infection, generalised sepsis and long term complications of open wound. Considering all the above facts, it appears that, there is a need to go for a protective study on laparoscopic appendicectomy for acute appendicitis and its early complications to decrease post operative complications and morbidity of open appendectomy. So we propose to conduct the present study to document the outcome of laparoscopic appendicectomy and its effectivity in managing acute appendicitis and its early complication among the patients.

ANATOMY:



The appendix, ileum and ascending colon are all derived from the

midgut. The appendix first appears at the eighth week of gestation as an out pouching of the caecum. Then it rotates gradually to a more medial location with the rotation of the gut and caecum becomes fixed in the right lower quadrant.

Appendix is situated at the terminal end of the caecum where three taenia coli join. It is about 2cms below the ileo-caecal orifice. The mesocolic, free and omental taeniae can be traced to reach the base of the appendix. Appendix is usually of 5-10 cms in size. But the size can be variable from 2-20 cms. Size of the lumen is approximately that of a match stick. Diameter of the appendix is 3-8mm and the lumen of appendix is 1-3mm. The mesoappendix which is an extension of mesentery contains the appendicular artery that is a branch of the ileocolic artery. The ileo-colic artery is a branch of the Superior Mesenteric artery. Often an accessory appendicular artery may be present. Thrombosis of these vessels leads to gangrenous appendicitis.

Different anatomical position of the tip of appendix:

- 1) Retrocaecal (75%) – Most common position.
- 2) Pelvic (21%) – Second most common.
- 3) Pre-ileal (anterior)
- 4) Post-ileal
- 5) Para-caecal
- 6) Sub faecal
- 7) Sub hepatic

The varying location of the tip of the appendix likely explains the myriad of symptoms those are attributed to the inflamed appendix. The appendix, sometimes may lie in a sub serial plane causing difficulty during the dissection of the appendix. In case of situs inversus, appendix lies in the left side. Appendix may be more than one in number in some cases. This is known as duplication of appendix .

According to the Wallbridge Classification, it is classified as –

- TYPE A – Partial duplication in a single caecum.
- TYPE B – Two separate appendix in a single appendix.
- TYPE C – Double caecum with each one having one appendix.

AETIOLOGY:

Acute appendicitis is mainly caused by the obstruction of its lumen, which is caused by faecolith or appendicolith, lymphoid hyperplasia, vegetable matter, seeds, parasites and neoplasm. This type of appendicitis is called acute obstructive appendicitis. Luminal obstruction of appendicitis is associated with mucous and inflammatory fluid collection within the lumen and eventual increase in the intraluminal pressure. It leads to blockage of the lymphatic and venous drainage and is resulted in increased oedema of mucosa and wall of appendix leading to mucosal ulceration and oedema. Bacterial translocation is occurred and spreading of bacteria into submucosa and muscular propria leads to the development of acute obstructive

appendicitis. The resultant thrombosis of the appendicular artery leads to the ischemic necrosis of full thickness of the wall of the appendix. Eventual perforation at the tip or at the base of appendix may lead to peritonitis. After perforation, the infective process is localised by greater omentum and dilated ileum. Generation of suppuration and pus lead to the development of appendicular abscess. Its localisation can occur by omentum and dilated ileum without pus inside then appendicular mass or lump is formed. Acute appendicitis with blockage at the lumen leads to enlargement of appendix and the collection of mucous within the lumen of appendix that leads to development of the mucocele of appendix. Acute inflammation of the mucous membrane with secondary infection without obstruction causes non obstructive appendicitis. It may lead into resolution, fibrosis, recurrent appendicitis or eventual obstructive appendicitis. Among organisms associated with development of acute appendicitis. E. coli is the main organism. Enterococci, Streptococci, Anaerobic Streptococci, Clostridium Welchii and Bacteroides are also associated with the development of acute appendicitis.

Complications of laparoscopic appendectomy for acute appendicitis and its early complications:

PEROPERATIVE COMPLICATIONS:

BLEEDING: it may occur during the port placement and during the dissection of the inflamed appendix. The cases are done by coagulating the mesoappendix by bipolar diathermy followed by cutting the mesoappendix by the scissor. By doing this way, the chances of bleeding during dissection becomes less. 5 cases are associated with significant bleeding during dissection.

SPILLAGE OF FAECOLITH: Obstructive acute appendicitis is very commonly associated with presence of faecolith within the appendicular lumen. Intraperitoneum abscess may occur due to the spillage of faecolith during the laparoscopic appendectomy. Spillage of faecolith is occurred in 3 cases. Those are removed.

GUT INJURY: it may occur during dissection. In our series, gut injury is nil.

DIATHERMY BURN: Particularly, Cecum, ascending colon or small intestine may occur inadvertently during the coagulation of the mesoappendix. Careful cauterisation must be done to avoid it. The incidence of diathermy burn is nil out of 100 cases.

POST OPERATIVE COMPLICATIONS:

- WOUND INFECTION:** the port sepsis is the main form of wound infection after Laparoscopic appendectomy in acute appendicitis. Out of 100 cases, 12 cases are associated with wound infection.
- CHEST COMPLICATIONS:** Patients may develop respiratory distress in the post operative period due to impairment of the pulmonary function. It is mostly due to sepsis induced lung injury. But several anaesthesia related derangement of lung function may also occur after appendectomy. Chest complications are developed in 2 cases among 100 cases of laparoscopic appendectomy.
- FAECAL FISTULA:** it may occur when appendectomy is gangrenous or perforated and liable base appendix. It can occur if appendectomy is done or tried in appendicular mass. If the underlying appendicular pathology is Crohn's disease or carcinoma or ileocaecal tuberculosis then the chance of development of faecal fistula is more after appendectomy. Out of 100 cases of laparoscopic appendectomy performed, the occurrence of postoperative faecal fistula is nil.
- PORT SITE HERNIA:** late complications of laparoscopic surgery. After 3 months follow up, among the 100 cases of laparoscopic appendectomy, no one has developed port site hernia.
- SCAR DISCHARGE AND PAIN:** it is late complication. After 3 months follow up, the occurrence of Scar discharge and pain is nil among the 100 cases performed.

MATERIALS AND METHODS:

STUDY AREA: Department of General Surgery.

STUDY POPULATION: patients admitted for the treatment of Scar discharge and pain and its early complications.

STUDY PERIOD: January 2015 to June 2016 (One And half year).

SAMPLE SIZE: 100 patients.

SOURCE OF DATA: Data are collected in specific predetermine proforma from 100 patients operate for acute appendectomy and its early complications.

SAMPLE DESIGN: Male and female patients of 15 to 65 years of age.

STUDY DESIGN: prospective study.

PARAMETERS STUDIED:

Clinical parameters.

Routine investigation and reports.

Specific investigations report of USG abdomen.

Port placement.

Operative findings.

Peroperative complications.

Post operative morbidity and complications.

INCLUSIONS CRITERIA:

Acute appendicitis. Subacute appendicitis.

Early appendicular lump within 5 days of acute symptoms.

Appendicular perforation.

EXCLUSION CRITERIA:

Appendicular abscess.

Late appendicular lump after 5 years of acute symptoms.

Unfit for anaesthesia.

Unfit for laparoscopic surgery.

STUDY TOOLS:

Specific predetermine proforma.

Investigations reports.

Laparoscopic OT setup.

STUDY TECHNIQUES:

(a). Patients with pain abdomen admitted through Emergency or Surgery OPD, clinically diagnosed as acute appendicitis or its early complications are included within our study. All the cases are posted for laparoscopic appendectomy.

(b). among the 100 cases posted for laparoscopic appendectomy 98 cases are done by laparoscopic approach and 2 cases are converted to open appendectomy. The laparoscopic appendectomy is done by conventional 3 ports laparoscopic appendectomy method. The 1st 10 mm port is made in umbilicus, the 2nd 10 mm/5 mm port is made in the LIF or suprapubic region. The 3rd port of 5 mm is made in the RIF according to the anatomical position of appendix. The ports are placed in such manner that an equilateral triangle is created. The OT table is placed in Trendelenburg's position with leftward tilting position. In all cases, after creating the 10 mm umbilical port, the telescope is introduced to check the position of the umbilicus. In 7 cases, the cecum is found in high up position and therefore modified port placement is done. The operation is performed in antitrendelenburg position.

After inserting the telescope, a quick abdominal survey is done. The appendix is held with Babcock type or blunt grasper through the 3rd port. Mesoappendix is coagulated with the bipolar diathermy and then cut with scissor. Extracorporeal endoloop prepared with 1-0 silk are used for ligation of the base of the appendix in 90 cases. Preformed endoloop available commercially, are used to ligate in rest of 10 cases. The appendix is delivered through the umbilical port. In cases of early appendicular lump, the adherent loops of omentum and small bowels are gently peeled away using the blunt dissection with sucker nozzle. In cases of appendicular perforation, cleaning of the exudates is done by suction and irrigation with normal saline. 18G Ryle's tubes are placed in the pelvis through 3rd port in those cases. Finally the ports are closed by the port closure suture.

(c). In post operative periods, parenteral antibiotics, analgesics, H2 blockers are given as per requirement. The intravenous fluid is maintained until the next day. The liquid diet is started after the day of operation. The patients are discharged on the 2nd or 3rd post operative day, depending upon the clinical condition of the patient. The patients are looked after for 3 month follow up cases.

ANALYSIS OF DATA:

All recorded data from the completed proforma are analysed with suitable diagrams, figures, tables and findings are discussed in details to draw appropriate conclusions using SPSS software and standard statistical analysis.

RESULTS AND ANALYSIS

Table 1. Age Distribution:

15 – 30 years	31 – 50 years	51 – 65 years
56	34	10

● 15-30 Yr ● 31-50 Yr
● 51-65 Yr

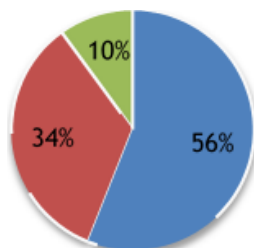


Table 2. Sex Distribution :

Male	Female
76 cases	24 cases

Table 3. Distribution of Cases:

Appendicular Lump	Appendicular Perforation	Acute appendicitis (USG Proved/Without Sequelae)	
		Gangrenous	Oedematous And Thick appendix
27 Cases	8 cases	13 cases	52 cases

- appendicular lump
- appendicular perforation
- acute appendicitis gangrenous
- acute appendicitis oedematous and thick appendix

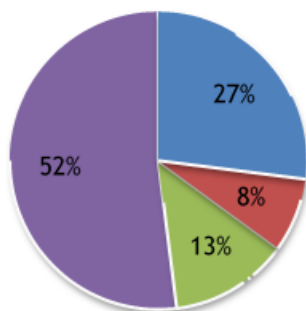


Table 4. Position of appendix

Sub Caecal	Para Caecal	Retro Caecal
68 Cases	23 Cases	9 Cases

Table 5. Type of Port Placement

Conventional Three Port Placement	Modified Port Placement
93 cases	7 cases

Table 6. Duration of Operation

12 – 30 Minutes	21 – 30 Minutes	31 – 60 Minutes	60 – 94 Minutes
32 Cases	28 Cases	23 Cases	17 Cases

Table 7. Per Operative Findings

Spillage Of Fecolith	Peritoneal Lavage	Drain Given	Nothing Significant
3 Cases	21 Cases	13 Cases	63 Cases

Table 8. Postoperative Complication

Wound Infection	Chest Complication	Intraperitoneal Sepsis	None
4 Cases	2 Cases	0 Cases	94 Cases

Table 9. Discharged On

2 nd Post Operative Day	3 rd Post Operative Day	4 th Post Operative Day
10 Cases	80 Cases	10 Cases

Table 10.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		79	79.0%	79.0%	79.0%
1	PERITONEAL LAVAGE	21	21.0%	21.0%	100.0%
Total		100	100.0%		
		Frequency	Percent	Valid Percent	Cumulative Percent

Valid		87	87.0%	87.0%	87.0%
2	DRAIN GIVEN	13	13.0%	13.0%	100.0%
Total		100	100.0%		
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		96	96.0%	96.0%	96.0%
3	WOUND INFECTION	4	4.0%	4.0%	100.0%
Total		100	100.0%		
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		98	98.0%	98.0%	98.0%
4	CHEST COMPLICATIONS	2	2.0%	2.0%	100.0%
Total		100	100.0%		
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		97	97.0%	97.0%	97.0%
5	FECOLITH SPILLAGE	3	3.0%	3.0%	100.0%
Total		100	100.0%		

Table 11.

Table: Case Summary				
PERITONEAL LAVAGE	Unweighted	Weighted		
Positive	79	79.00		
Negative	21	21.00		
Table: Area Under the Curve				
	Area	Std. Error	Sig. (P value)	Asymp. 95% Confidence Interval
Variable under test				Lower Bound
	0.23	0.07	0.000	0.12
Table: Coordinates of the Curve				
Test variable	Positive if greater than or equal to	Sensitivity	1 - Specificity	
PERITONEAL LAVAGE	1	1.00	1.00	
	3	0.87	1.00	
	4	0.00	0.48	
	5	0.00	0.00	

Table 12.

Table: Case Summary					
DRAIN GIVEN	Unweighted	Weighted			
Positive	87	87.00			
Negative	13	13.00			
Table: Area Under the Curve					
	Area	Std. Error	Sig. (P value)	Asymp. 95% Confidence Interval	
Variable under test				Lower Bound	Upper Bound
	0.14	0.07	0.000	0.03	0.26
Table: Coordinates of the Curve					
Test variable	Positive if greater than or equal to	Sensitivity	1 - Specificity		

DRAIN GIVEN	1	1.00	1.00		
	3	0.89	1.00		
	4	0.01	0.69		
	5	0.00	0.00		

Table 13.

Table: Case Summary					
WOUND INFECTION	Unweighted	Weighted			
Positive	96	96.00			
Negative	4	4.00			
Table: Area Under the Curve					
	Area	Std. Error	Sig. (P value)	Asymp. 95% Confidence Interval	
Variable under test				Lower Bound	Upper Bound
	0.03	0.02	0.002	0.00	0.06
Table: Coordinates of the Curve					
Test variable	Positive if greater than or equal to	Sensitivity	1 - Specificity		
WOUND INFECTION	1	1.00	1.00		
	3	0.90	1.00		
	4	0.06	1.00		
	5	0.00	0.00		

Table 14.

Table: Case Summary					
CHEST COMPLICATIONS	Unweighted	Weighted			
Positive	98	98.00			
Negative	2	2.00			
Table: Area Under the Curve					
	Area	Std. Error	Sig. (P value)	Asymp. 95% Confidence Interval	
Variable under test				Lower Bound	Upper Bound
	0.50	0.17	1.000	0.22	0.78
Table: Coordinates of the Curve					
Test variable	Positive if greater than or equal to	Sensitivity	1 - Specificity		
CHEST COMPLICATIONS	1	1.00	1.00		
	3	0.90	1.00		
	4	0.10	0.00		
	5	0.00	0.00		

Table 15.

Table: Case Summary					
FECOLITH SPILLAGE	Unweighted	Weighted			
Positive	97	97.00			
Negative	3	3.00			
Table: Area Under the Curve					

	Area	Std. Error	Sig. (P value)	Asymp. 95% Confidence Interval	
Variable under test				Lower Bound	Upper Bound
	0.04	0.02	0.006	0.00	0.07
Test variable	Positive if greater than or equal to	Sensitivity	1 - Specificity		
FECOLITH SPILLAGE	1	1.00	1.00		
	3	0.90	1.00		
	4	0.07	1.00		
	5	0.00	0.00		

ANALYSIS:

In table number 10, total 21% patients require peritoneal lavage, 13% patients are equipped with drain during operation, 4% shows wound infection postoperatively, 2% shows chest complication post operatively, 3% patients shows fecolith spillage during operation. SPSS software is used for statistical calculation and excel is used for data analysis. ROC curve is formed between sensitivity and specificity for both methods i.e open and lap appendectomy for every complication and area under curve is calculated. P value is derived from area under curve as shown in table 11- 15. Continuous baseline descriptive variables were expressed as mean with standard deviation (SD) and were compared using Mann-Whitney test. Categorical variables were expressed as absolute number and proportion. Spearman rank correlation analysis was used for evaluation of the correlation between each pair.

Out of the 5 complication variable computed 4 comes out to be significant with extreme left corner value in ROC and 1 comes out to be non significant. Peritoneal lavage, drain given, post operative wound infection, and fecolith spillage intra operatively are found to be significant with p value as < 0.001, < 0.001, 0.002, 0.006 respectively. Chest complication shows no significant reduction in laparoscopic appendectomy with p value as 1.0.

DISCUSSION

Appendectomy is the most commonly performed emergency abdominal surgical procedure. Open appendectomy is the method, commonly used procedure but the scenario is changing gradually with the wide spread availability of laparoscopic surgery. Over the period of last one decade, the laparoscopic appendectomy in acute appendicitis is becoming gradually the procedure of choice. Multiple prospective randomised trial have shown that laparoscopic appendectomy in acute appendicitis and its early complications as re associated with shorter recovery time and less post operative complications (1).

We have performed a hospitality based prospective study over 18 months period to evaluate the feasibility and safety of the laparoscopic appendectomy in acute appendicitis and its early complications. We have studied the morbidities associated with the procedure and the verge hospital stay of the patient after laparoscopic appendectomy in acute appendicitis and its early complications. We have taken into consideration 100 cases of acute appendicitis, who have been admitted in our institution during the study period. Maximum number of patients in our study is the age group of 16 to 30 years, amounting 56%. Minimum age of patients is 15 years and maximum age 65 years. Out of 100 patients, we have taken in our study; male patients are 76 and female patients are 24 in number. In our series we have performed preoperative investigations of ultrasonography, ECG, Complete blood count, fasting blood sugar, capillary blood glucose tests per as practicable. We have not encountered any cardiological problems in our patients during or after the operation. As well as, we have performed the laparoscopic appendectomy by the tripple port method. Among the 100 cases, 93 cases are done by conventional port placement method. Rest of the 7 cases are done by modified port placement method due to high up position of the cecum. Among the 100 cases performed, appendicular lump are associated with 27 cases and appendicular perforation are found in 8 cases. In 13 cases we have found gangrenous appendicitis.

Oedematous and thick appendixes are found in 52 cases. According to the position of the appendix, our finding in the study as follows

–Subcaecal – 68 cases; Paracaecal – 23 cases; Retrocaecal – 9 cases. Cecum is positioned high up in 7 cases. The average duration of operation (skin to skin) in our study is 15 to 94 minutes. During the laparoscopic procedure, spillages of faecolith are occurred in 3 cases. Peroperative peritoneal lavages are given in 21 cases. Abdominal drains are placed in 13 cases (2). Significant bleeding during the dissection of the appendix are encountered in 5 cases. We have not found any case of gut injury and diathermy burns during the procedure. In the post operative stage, we have not encountered a single case of intra peritoneal sepsis. Because the antibiotics, like higher generations cephalosporins and penems are available in our wards. We have faced wound infection or port sepsis in 4 cases. It is particularly associated with perforated and gangrenous appendix (4). In the post operative stage, chest complications are developed in 3 cases. The occurrence of post operative faecal fistula in our study is nil. Out of 100 cases performed, in 2 cases of appendicular lump, the conversion the procedure is done. The appendectomy is completed by open method (5).

2nd post operative day onwards, injectable antibiotics are not required. Only oral analgesics are given from 2nd post operative day to achieve the desired pain relief (3). In our series, 10 cases are discharged on 2nd post operative day. 80 cases are discharged on 3rd post operative day and 10 cases are discharged on 4th post operative day. No patient has been detected with wound pain or discharged within 15 days of post operative follow up period. In our series, after 3 months of post operative follow up of 100 cases, we have not come across any case of scar discharge, pain or herniation. My review of available literature on the subject based on the works done by different authors; substantiate my finding that laparoscopic appendectomy in acute appendicitis and its early complications is a very safe and effective procedure.

SUMMARY AND CONCLUSION

By performing the laparoscopic appendectomy in acute appendicitis and its early complications, we have found that the laparoscopic procedure is associated with fewer cases of post operative wound infection (p value 0.002) and faecolith spillage (p value 0.006). In this study chest complications shows no significant correlation and no advantage in laparoscopic procedure (P value 1.0). The post operative analgesic requirement is minimum as the laparoscopic procedure is characterised by less painful. This helps in early mobilisation of the patient and early return to work. Laparoscopic appendectomy is associated with better patient acceptance as the cosmesis is more satisfactory. As we have operated early appendicular lump, faecal fistula has not developed in any cases. Laparoscopic procedure has some distinct advantages (p value < 0.001) during the operation of the perforated appendix. As peritoneal toileting can be done properly due to improved exposure of the local area and pelvic cavity during laparoscopy. Similarly, the placement of the abdominal drain can be done under direct vision in the dependent part of the peritoneal cavity during laparoscopic surgery much easier way (p value < 0.001). The patient may start normal activities within 15 days. From the socio-economic point of view, the cost of the therapy is much less due to the early return of the patient to normal routine. Long term complications, like scar pain, discharge or incisional hernia are found to be extremely low.

From our series, we have come to the conclusion that laparoscopic appendectomy in acute appendicitis and its early complications are associated with fewer per operative and early and late post operative complications. Furthermore, the return of the patients to normal work is much early and the cosmetic outcome is good in laparoscopic appendectomy. Chest complications derive no significant reduction during laparoscopic appendectomy.

We can sum up by saying that laparoscopic appendectomy in acute appendicitis and its early complications is a very safe and effective procedure and should be taken up as the standard method of treatment.

Available literature, both ancient and recent, reviewed as per as practicable to get a comprehensive idea of the subject on the basis of the works done by different authors.

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