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Original Research Article

A prospective comparative study of retrieval of gall bladder using endobag and without endobag in laparoscopic cholecystectomy

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ABSTRACT

Background: Laparoscopic cholecystectomy (LC) is the gold standard for the management of symptomatic gallstone disease. However, intraoperative gallbladder perforation, bile spillage, and gallstone dissemination may increase the risk of port-site infection (PSI). The use of an endobag during specimen retrieval has been proposed to reduce these complications, but its routine necessity remains debated.
Methods: This prospective comparative study included patients undergoing elective laparoscopic cholecystectomy. Participants were randomized into two groups: group A (endobag used for gallbladder retrieval) and group B (direct extraction without endobag). Outcomes assessed included bile spillage, port-site infection, operative time, and postoperative hospital stay. Statistical analysis was performed using appropriate parametric and non-parametric tests, with a $p<0.05$ considered statistically significant.
Results: Port-site infection occurred significantly less in the endobag group compared to the non-endobag group. Intraoperative bile and stone spillage were also significantly reduced in group A. No statistically significant difference was observed in operative time or duration of hospital stay between the two groups.
Conclusions: The use of an endobag during laparoscopic cholecystectomy significantly reduces port-site infection and intraoperative bile spillage without increasing operative time or hospital stay. Routine use of an endobag is recommended, especially in high-risk patients.

Keywords: Laparoscopic cholecystectomy, Gall stone disease, Port site infection, Endobag, Bile spillage

INTRODUCTION

The prevalence of gallstone disease (GSD) varies in different parts of India. In North India gallstone disease is prevalent in about 10-15% of adults and has become a major health problem. Prevalence of GSD in females is more than double as compared to males. An epidemiological study in 1966 demonstrated in railroad workers that gallstones occurred seven times more frequently in north Indians than in South Indians.[1]

Cholecystectomy is the surgical removal of gall bladder. It can be performed laparoscopically, Robotics, NOTES, or by a more invasive method-open cholecystectomy. Laparoscopic cholecystectomy is the gold standard treatment for majority of patients with gall bladder disease because it is associated with less pain, less hospital stays, rapid turnover of patients, cosmetically better and faster return to normal activity than after open cholecystectomy.[2]

Cholecystectomy if done laparoscopically has gall bladder perforation, stone spillage, and biliary injury as common complications that mainly occur while its dissection from hepatic bed resulting in spillage into the peritoneal cavity. The incidence reported ranges from 10% to 40% for perforation and from 6% to 30% for the spilling of the contents. Gallbladder distended with stones always creates problems in retrieval so needle decompression, fragmentation, or increase in the fascial incision to

facilitate retrieval, cause postoperative pain at the port site.[3]

Since the introduction of laparoscopic surgery for gallbladder stones, different types of retrieval devices have been used to extract the gallbladder from the peritoneal cavity. These ranged from simple non-powdered gloves to several types of commercially produced bags. Laparoscopic cholecystectomy is associated with more chances of intra-abdominal stone spillage, implantation and port-site contamination during retrieval of gall-bladder specimen.

The use of retrieval devices has been advocated for many advantages, including the prevention of wound infection and avoidance of port site metastasis. In laparoscopic cholecystectomy, the use of endobag is thought to provide the further benefit of reducing the risk of stone spillage into the peritoneal cavity and the port site infection rate.[4]

To minimize the port site infection many surgeons have advised for the use of endobag for extracting gallbladder as it minimizes the bile spillage and hence reduces the surgical site infection. After dissecting the gallbladder from gallbladder fossa the gallbladder is put in small bag and retrieved out through 10mm epigastric port so that spillage of bile in the peritoneal cavity and at port site is minimized as compared to retrieval without endobag.[4]

In case of larger stones decompression of the gallbladder inside the peritoneal cavity can be done within Endobag and it also became easier to retrieve without increasing the skin incision.[5] Endobag is of great value also if used in suspected cases of GB cancer to minimize the incidence of tumor cell seedling at port site and in cases of acute cholecystitis and empyema of the GB to avoid contamination of the wound with infected bile or stones during retrieval of the GB.[6,7]

The use of an endobag during gallbladder extraction has been advocated to minimize contamination, reduce bile spillage, and lower port-site infection rates. However, routine application remains controversial due to additional cost and lack of uniform evidence. This study aims to evaluate the effectiveness of endobag usage in reducing postoperative port-site infections and operative complications during laparoscopic cholecystectomy.

Aim

The aim was to evaluate the port site infection rate in laparoscopic cholecystectomy with and without endobag.

Objectives

The primary objectives were to assess the port site infection rate in laparoscopic cholecystectomy with the use of endobag and without endobag and secondary objectives were to assess the length of hospital stay, to assess the postoperative pain and to assess the bile spillage and gallstone spillage after dissecting the gallbladder.

METHODS

Study design

The following study was a prospective cohort study which was conducted in the Department of General Surgery at Pt. B.D. Sharma PGIMS, Rohtak after approval from Institutional Ethical Committee.

Study period

The study was conducted for one year (01 May 2024 to 30 April 2025).

Study subjects

The study included all patients with cholelithiasis admitted in single unit of Pt. B.D PGIMS Rohtak undergoing laparoscopic cholecystectomy.

Inclusion criteria

All patients with cholelithiasis admitted in single unit of Pt. B.D Sharma PGIMS Rohtak undergoing laparoscopic cholecystectomy during one year were included in this study.

Exclusion criteria

Patients having high BMI (>35), proven congenital anomaly of gall bladder, previous multiple abdominal surgeries, immunocompromised patients and cholecystitis with complication (empyema or perforation) were excluded.

Sample size

Sample size was calculated on basis of previous study by Ahmed et al. Frequency of port site wound infection with and without end gloves techniques of retrieval of gallbladder in pouch after laparoscopic cholecystectomy for chronic calculus cholecystitis. In the study, type I error (alpha, significance), Zα was 1.96, Z1-β was 0.84, power was 80%, percentages of effect was 4.23% (base on post-op wound infection) and standard deviation (σ) was 0.07.

The study included 39 patients in each group.

This case control study was conducted in PGIMS, Rohtak for the period of 1 year from May 2024 to April 2025. This study includes 78 patients with ultrasound proven cholelithiasis selected on the basis of above-mentioned criteria. The patients divided into two groups group A with 39 patients who underwent laparoscopic cholecystectomy with endobag. Group B with include 39 patients underwent laparoscopic cholecystectomy without endobag. Patients will be evaluated clinically with proper history taking,

general physical examination and systemic examination. Pre-operative haematological and biochemical investigations was sent along with radiological workup.

Injection ceftriaxone 1 gm IV is as prophylactic antibiotic in both the groups. In laparoscopic cholecystectomy 10mm epigastric working port, 10 mm umbilical port for telescope and two other 5 mm ports for surgeon's assistance. After dissecting the gallbladder from the gall bladder fossa the gallbladder is put in the endobag and retrieved out through 10 mm epigastric port and in both the groups the 10mm ports closed by vicryl while other two 5 mm ports were closed by nylon only. Post operatively injection Diclofenac 75 mg 8 hourly used as analgesics. Daily aseptic dressing was done (Figures 1 and 2).

Figure 1: Extraction of gall bladder which is inside the endobag through epigastric port.

Figure 2: Gallbladder extraction without endobag showing gallbladder rupture.

Patient was assessed intraoperatively for bile spillage, any other foci of infection, perforated gallbladder and if aseptic precautions were maintained. Patient was assessed postoperatively for port site infection till 14 days after laparoscopic cholecystectomy.

Statistical analysis and sample size calculation for the present study were performed using IBM statistical package for the social sciences (SPSS) statistics. The sample size was estimated based on the findings of the previous study by Ahmed et al, considering a 95% confidence interval, 80% study power, type I error (α) of 0.05, and the expected difference in postoperative wound infection rates between the two groups. The calculated minimum sample size was 78 patients, with 39 patients included in each group. Statistical package for the social sciences (SPSS) software was further used for data entry, data management, and statistical analysis of study variables.

RESULTS

Distribution of the participants in terms of age

25.6% of the participants had age between 18-30 years. 33.3% of the participants had age between 31-40 years. 23.1% of the participants had age between 41-50 years. 17.9% of the participants had age between 51- 60 years, indicating clearly 31-40 years age group predominance in the study participants (Table 1).

Table 1: Distribution of the participants in terms of age.

Age (years)	Frequency	Percentage	95% CI (%)
18-30	20	25.6	16.4-36.8
31-40	26	33.3	22.9-44.9
41-50	18	23.1	14.2-34.0
51-60	14	17.9	9.9-28.6

Distribution of the participants in terms of gender

Out of the total participants, 12 were males which is 15.4% and 66 were female patients which is 84.6%, indicating clearly a female predominance in the study participants (Table 2).

Table 2: Distribution of the participants in terms of gender.

Gender	Frequency	Percentage	95% CI (%)
Male	12	15.4	8.2-25.4
Female	66	84.6	74.6-91.8

Distribution of the participants in terms of diabetic

Out of the total participants, 6 participants had diabetes which is 7.7%and 72 of the participants had no diabetes which is 92.3% (Table 3).

Table 3: Distribution of the participants in terms of diabetic.

Diabetic	Frequency	Percentage	95% CI
Yes	6	7.7	3.6-15.8
No	72	92.3	84.2-96.4

Association between endobag and port site infection

Chi-square test was used to explore the association between 'endobag' and 'port site infection'.

There was a significant difference between the various groups in terms of distribution of port site infection (χ^2=5.01, p=0.025).

17.9% of the participants in the group B (non endobag group) had port site infection and 82.1% of the participants in the group B (on endobag group) had no port site infection. 2.6% of the participants inthe group A (endobag group) had port site infection and 97.4% of the participants in the group A (endobag group) had no port site infection.

Participants in the non endobag group had the larger proportion of port site infection compared to participants in the endobag group (Table 4).

Association between endobag and bile or stone spillage

Chi-square test was used to explore the association between 'endobag' and 'bile or stone spillage'. There was a significant difference between the various groups in terms of distribution of bile or stone spillage (χ^2=11.47, p≤0.001).

25.64% of the participants in the group B (non endobag group) had bile or stone spillage and 74.36% of the participants in the group B (non endobag group) had no bile or stone spillage. 0.0% of the participants in the group A (endobag group) had bile or stone spillage. 100.0% of the participants in the group A (endobag group) had no bile or stone spillage. Participants in the non endobag group had the larger proportion of bile or stone spillage compared to participants in the endobag group (Table 5).

Association between endobag and UPATS score (6 hours)

The variable UPATS score (6 Hours) was not normally distributed in the 2 subgroups of the variable endobag. Thus, non-parametric tests (Wilcoxon-Mann-Whitney U test) were used to make group comparisons.

The mean (SD) of UPATS score (6 hours) in the non endobag group was 1.87 (0.86). The mean (SD) of UPATS score (6 hours) in the endobag group was 2.07 (0.99). The median (IQR) of UPATS score (6 hours) in the non endobag group was 2 (1-2). The median (IQR) of UPATS score (6 hours) in the endobag group was 2 (2-2). The UPATS score (6 hours) in the non endobag group ranged from 1-4. The UPATS score (6 Hours) in the endobag group ranged from 1-6 (Table 6).

Table 4: Association between endobag and port site infection.

Port site infection	Endobag			Chi-squared test	
	Not used (%)	Used (%)	Total (%)	χ^2	P value
Yes	7 (17.9)	1 (2.6)	8 (10.3)		
No	32 (82.1)	38 (97.4)	70 (89.70)	5.01	0.025
Total	39 (100.0)	39 (100.0)	78 (100.0)		

Table 5: Association between endobag and bile or stone spillage.

Bile or stone spillage	Endobag			Chi-squared test	
	Not used (%)	Used (%)	Total (%)	χ^2	P value
Yes	10 (25.64)	0 (0.0)	10 (12.82)		
No	29 (74.36)	39 (100.0)	68 (87.18)	11.47	<0.001
Total	39 (100.0)	39 (100.0)	78 (100.0)		

Table 6: Association between endobag and 'UPATS score (6 hours).

UPATS score (6 hours)	Endobag		Wilcoxon-Mann-Whitney U Test	
	Not used	Used	W	P value
Mean (SD)	1.87 (0.86)	2.07 (0.99)		
Median (IQR)	2 (1-2)	2 (2-2)	2490.500	0.173
Min-max	1-4	1-6		

There was no significant difference between the groups in terms of UPATS score (6 hours) (W=2490.500, p=0.173).

Similarly, UPATS score for 12 hours and 24 hours was observed and there was no significant difference between the groups in terms of UPATS score (12 hours) (W=2675.500, p=0.442); UPATS score (24 hours) (W=2652.500, p=0.235).

Association between endobag and severity of pain (6 hours)

Chi-squared test was used to explore the association between 'endobag' and 'severity of pain (6 hours)'. There was no significant difference between the various groups in terms of distribution of severity of pain (6 hours) (χ^2=0.10, p=0.75).

Similarly, there was no significant difference between the various groups in terms of distribution of severity of pain (12 hours) (χ^2=2.778, p=0.61); of distribution of severity of pain (24 hours) (χ^2=0.51, p=0.47) (Table 7).

Association between endobag and duration of hospital stay (days)

The variable duration of hospital stay (days) was not normally distributed in the 2 subgroups of the variable endobag. Thus, non-parametric tests (Wilcoxon-Mann-Whitney U test) were used to make group comparisons. The mean (SD) of duration of hospital stays (days) in the non endobag group was 1.96 (0.81). The mean (SD) of duration of hospital stays (days) in the endobag group was 2.27 (1.12). The median (IQR) of duration of hospital stays (days) in the non endobag group was 2 (1-2). The median (IQR) of duration of hospital stays (days) in the endobag group was 2 (1.5-3). The duration of hospital stays (days) in the non endobag group ranged from 1–4 days. The duration of hospital stays (days) in the endobag group ranged from 1–6 days.

There was no significant difference between the groups in terms of duration of hospital stay (days) (W=2452.500, p=0.150) (Table 8).

Table 7: Association between endobag and severity of pain (6 hours).

Severity of pain (6 hours)	Endobag			Chi-squared test	
	Not used (%)	Used (%)	Total (%)	χ^2	P value
Mild	34 (87.2)	33 (84.6)	67 (85.9)		
Moderate	5 (12.8)	6 (15.4)	11 (14.1)	0.10	0.75
Total	39 (100.0)	39 (100.0)	78 (100.0)		

Table 8: Association between endobag and 'duration of hospital stay (days).

Duration of hospital stay (days)	Endobag		Wilcoxon-Mann-Whitney U test	
	Not used	Used	W	P value
Mean (SD)	1.96 (0.81)	2.27 (1.12)		
Median (IQR)	2 (1-2)	2 (1.5-3)	2452.500	0.150
Min-max	1-4	1-6		

DISCUSSION

This study was carried out in the Department of General Surgery Pt. B.D. Sharma PGIMS, Rohtak. It involved 78 patients with symptomatic gallstone disease who were divided into two groups (A and B). In group A (endobag group), the gallbladder was extracted using an endobag, whereas in group B (non endobag group), the gallbladder was extracted without an endobag.

Age

Out of the total 78 patients, 20 (25.60%) fall under the age range of 18-30 years, 26 (33.30%) fall under the age range of 31-40, 18 (23.10%) fall under the age range of 41-50 years, and 14 (17.90%) fall under the age range of 51-60 years. In the study by Qassem et al showed mean age in the endobag group was 41.34 years (SD=±11.73) and mean age in the non-endobag group was 42.96 years (SD=±10.53).[8]

Most patients in both groups were between 30–50 years, showing similar trends to the current study. Bharath et al in their study reported a female predominance and a mean age of 42.1 years in the endobag group and 43.5 years in the non-endobag group.[9] Both groups showed an age distribution skewed toward the 30–50 years range, consistent with current findings. Singh et al reported that the mean age of the study cohort was 39.8 years (SD=±9.4), with no significant difference between the endobag and non-endobag groups.[10] The study noted that the 30–40 years age group accounted for the majority of patients, reflecting patterns in the current analysis.

Across all studies, the majority of patients undergoing laparoscopic cholecystectomy, with or without endobag use, were in the 30-50 years age range, consistent with the current study. Mean ages in both groups across studies typically ranged from 40 to 48 years, with minor differences depending on the study's population.

The predominant age range reflects the peak incidence of gallbladder disease, which aligns with epidemiological data that indicate gallstone disease is more common in middle-aged individuals.

Gender

In our study, the female population consisted of 66 individuals, accounting for 84.6% of the total, while the male population consisted of 12 individuals, accounting for 15.40% of the total.

Another study by Bharath et al showed that endobag group consisted of 76% female and in non-endobag group females were 70%.[9] Gender distribution aligned closely with the current findings of female predominance.

Study by Ahmed et al, gender ratio (male-to-female) across all patients was 1:1.06, with a slight predominance of females.[11] Similar trends observed, although the gender gap was narrower in this study compared to others.

All studies, including the current one, report a predominance of female patients undergoing laparoscopic cholecystectomy, reflecting the higher prevalence of gallbladder disease among women due to hormonal factors and lifestyle patterns.

The current study aligns with this trend, showing that females constituted 79.5% of the endobag group and 89.7% of the non-endobag group. No significant difference in gender distribution was observed between the two groups, a finding echoed in all compared studies.

This uniformity in gender distribution reinforces the reliability of outcome comparisons between endobag group and non endobag group, as gender does not appear to be a confounding factor in the analysis of postoperative outcomes.

Port site infection

In the present study impact of endobag use on port site infections the use of endobag during laparoscopic cholecystectomy was significantly associated with a reduction in PSIs. In the group where endobag were used, only 1 (2.6%) experienced PSIs compared to 7 (17.9%) in the non-endobag group (p=0.025).

In the study done by Shakya et al the port site infection in group A was 2% and in group B was 10%.[12] Taj et al study showed that the port site infection was 5.28% without using endoglove, whereas it was 0.20% when using endoglove.[13]

In a study by Vergadia et al the PSI rate was 4% with endobag compared to 8% without, indicating a halving of infection risk.[14] Makhsosi et al observed a reduction in PSI rates to 3.6% with endobag compared to 7.6% without, though this difference was not statistically significant due to the sample size.[15]

Bhagwan et al noted a PSI rate of 1.1% in the endobag group versus 5.2% in the non-bag group, with most infections being superficial and requiring no major intervention.[16] Chinnaswami et al reported PSI rates of 1.4% and 9.1% in the bag and non-bag groups, respectively, with a statistically significant reduction (p<0.001).[17] These results highlight that endobags are particularly effective in preventing contamination by bile or gallstones during specimen retrieval, which is a primary cause of PSIs.

Overall, the studies strongly suggest that using endobags during gallbladder extraction minimizes the risk of PSIs, especially in high-risk patients, such as those with diabetes or immunosuppression.

Bile or stone spillage

Spillage, a known contributor to PSIs, was eliminated in the endobag group (0%), while it occurred in 25.64% of cases without endobag (p<0.001). This underscores the critical preventive role of endobag in laparoscopic procedures.

Similar results seen in study done by Bharath et al, the port-site spill occurred in no patients in group A and 12% of patients in group B, which is statistically significant.[9] In the study done by Singh et al, group A there was no spillage of stones and bile but in group B patients 3 (6%) patients had spillage of stones and bile.[10] The statistical analysis showed the difference to be insignificant (p=0.079). In group A patients, no port site spillage was present but in group B, 4 (8%) patients showed port site spillage. The statistical analysis showed that difference was significant p=0.04. Study by Qassem et al, PSI rate in the endobag group was 0% and non-endobag group was 12% (p=0.027).[8] Bile and stone spillage occurred in 16% of non-endobag cases versus 2% in the endobag group. Highlighted the strong correlation between spillage and PSIs, supporting endobag usage as a preventive measure.

Study by Singh et al showed PSI rate in the endobag group was 2% and non-endobag group was 8% (p<0.05) found that spillage prevention via endobag significantly reduced infections, aligning with the current study.[10]

This reduction is strongly associated with the prevention of bile and stone spillage, a critical factor in minimizing contamination and subsequent infections.

Although most infections in both groups were superficial, the economic and clinical implications of PSIs such as longer hospital stays and increased resource utilization underscore the importance of prevention. The findings of the current study align with the broader evidence, supporting the routine use of endobags in laparoscopic cholecystectomy to optimize outcomes and reduce complications.

UPATS score and severity of pain

The universal pain assessment tool score (UPATS) was used to evaluate postoperative pain at 6, 12, and 24 hours among patients undergoing laparoscopic cholecystectomy with and without the use of endobag. Across the groups, pain scores were slightly higher in the endobag group compared to the non-endobag group. At 6 hours, the mean UPATS score was 2.07 in the endobag group and 1.87 in the non- endobag group, with no statistically significant difference (p=0.173), at 12 hours, the mean UPATS scores were 1.32 (endobag group) and 1.17 (non-endobag group), again showing no significant difference (p=0.442) and at 24 hours, the mean scores were 1.19 and 1.07 for the endobag and non-endobag groups, respectively, with no significant difference (p=0.235).

This suggests that endobag usage does not significantly influence postoperative pain levels within the first 24 hours. Pain management protocols appeared effective across both groups, with most patients reporting mild pain during the postoperative period.

Across studies, pain scores decrease over time, regardless of endobag usage, with mild pain dominating by 24 hours postoperative. The use of an endobag during laparoscopic cholecystectomy has demonstrated mixed results regarding postoperative pain. While some studies report significantly reduced pain due to decreased spillage and surgical trauma, others, including the current study, find no statistically significant difference in pain levels. This variability may reflect differences in patient populations, surgical techniques, or pain management protocols.

Despite the lack of a statistically significant difference in some cases, endobag usage remains advantageous for reducing complications like spillage and infection, which indirectly contribute to better overall postoperative recovery.

Hospital stays in the groups

The duration of hospital stay is an important postoperative outcome, often influenced by complications such as bile or stone spillage and port site infections. The analysis compared hospital stay between patients where endobag were used and those where they were not.

Present study showed in non endobag group the mean duration of hospital stay was 1.96 days (SD=0.81). Median hospital stays were 2 days (IQR=1-2 days) and ranging from 1-4 days. In endobag group the mean duration of hospital stay was 2.27 days (SD=1.12). Median hospital stays were 2 days (IQR=1.5-3 days) ranging 1-6 days. There was no statistically significant difference in hospital stay duration between the groups (p=0.150), indicating that endobag usage did not directly affect overall hospital stay duration.

Port site infection in diabetic patients

In Diabetic patients PSI rate was 33.3%. Notable risk of infection in diabetics compared to non-diabetics. The association between diabetes and PSIs approached but did not reach statistical significance (p=0.153). In non-diabetic patients PSI rate was 12.5%. Infection rates significantly lower compared to diabetic patients.

Diclofenac use

Diclofenac was observed to effectively reduce postoperative pain in both endobag-used and non-endobag groups. Postoperative pain scores measured by UPATS (Universal Pain Assessment Tool Score) showed no significant differences between the groups, suggesting that diclofenac provided consistent pain relief regardless of procedural variation.

Limitations

This study was conducted at a single centre with a relatively small sample size, which may limit the generalizability of the findings. The short follow-up period restricted assessment of long-term postoperative outcomes. Variations in surgical technique, surgeon experience, patient comorbidities, and severity of gallbladder inflammation may also have influenced the results. Further large-scale multicentric studies with longer follow-up are recommended to validate these findings.

CONCLUSION

The present study demonstrates that the use of an endobag during laparoscopic cholecystectomy significantly reduces the incidence of port site infections by preventing bile and gallstone spillage during gallbladder retrieval. The non-endobag group showed a higher rate of intraoperative contamination and postoperative complications, highlighting the importance of specimen containment during extraction. Patients in the endobag group also demonstrated favorable outcomes in terms of postoperative pain and duration of hospital stay, although these differences were not statistically significant. Overall, the findings indicate that endobag-assisted retrieval enhances the safety and effectiveness of laparoscopic cholecystectomy and contributes to improved postoperative recovery and patient outcomes.

Recommendations

Based on the findings of this study, the routine use of an endobag during laparoscopic cholecystectomy is strongly recommended, particularly in patients with inflamed, infected, edematous, or friable gallbladders where the risk of bile and stone spillage is higher. The use of an endobag can help minimize port site contamination, reduce postoperative infections, and improve overall surgical outcomes.

Surgeons should consider incorporating endobag-assisted specimen retrieval as a standard practice in minimally invasive gallbladder surgery to enhance patient safety and reduce postoperative morbidity. Further multicentric studies with larger sample sizes and longer follow-up periods are also recommended to validate these findings and establish stronger clinical guidelines regarding the routine use of endobags in laparoscopic procedures.

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