Section: General Surgery

Original Research Article

A PROSPECTIVE STUDY ON EFFECT OF PERITONEAL CLOSURE VS NONCLOSURE ON POST OPERATIVE ANALGESIA REQUIREMENT IN EMERGENCY OPEN APPENDECTOMY IN A TERTIARY CARE HOSPITAL

Nagalekshmi G[1], Asik Roy G.V[2], Ram Praveen P[3], Geolin Mithun J[3]

[1]Associate Professor, Department of General Surgery, Kanyakumari Government Medical College, Asaripallam, Tamilnadu, India.
[2]Assistant Professor, Department of General Surgery, Government Stanley Medical College, Chennai, Tamilnadu, India.
[3]Assistant Professor, Department of General surgery, Kanyakumari Government Medical College, Asaripallam, Tamilnadu, India.

Received : 11/02/2025
Received in revised form : 08/04/2025
Accepted : 25/04/2025

Keywords:
Acute appendicitis, peritoneal closure, open appendectomy, postoperative analgesia.

Corresponding Author:
Dr. Ram Praveen P,
Email: rampraveen999@gmail.com

DOI: 10.47009/jamp.2025.7.2.240

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2025; 7 (2); 1191-1196

Abstract

Background: The aim of the study determine the effect of Peritoneal closure versus non closure on post operative analgesia requirement in cases of acute appendicitis undergoing emergency open appendectomy in a tertiary care centre. Peritoneum is mesenchymal in origin and unlike epidermis which heals from the borders peritoneum heals throughout the site and it reperitonises within 48-72 hours and complete healing occur within 5-6 days, so closing the peritoneum using sutures doesn't provide any additional advantages but rather evoke adverse responses. Its effect on post operative pain remains controversial and our study aims at analysing the effect of closure and nonclosure of peritoneum on post operative pain and other parameters. **Materials and Methods:** This study comprises of population of 100 patients admitted with a diagnosis of Acute Appendicitis undergoing Emergency open appendicectomy. Grid iron incision will be employed in all the cases. After appendectomy the peritoneum will be closed in Group A and left open in Group B, Rest of the layers will be closed as per standard practice. Post operatively Standard analgesia will be given to both groups and pain will be recorded using visual analogue scale (VAS) on day 0, day 1 and day 3. **Result:** Our study is a prospective randomised study, The demographic parameters were statistically insignificant. The duration of the procedure in the closure was 48.04 ± 4.16, and in non-closure was 32.74 ± 4.44. There is a significant difference in the duration of the procedure between groups (p=<0.0001). The mean VAS score at day 0,1,3 was lower in nonclosure group in a statistically significant manner (p=<0.0001). There is no significant difference in post-op wound infection between groups (p=0.24). There is a significant difference in the duration of hospital stay between groups (p=<0.0001). **Conclusion:** Non closure of peritoneum is associated with less duration of operative procedure when compared with closure group and the results were statistically significant. Post operative VAS scores and additional analgesia requirement between the two groups are also less in nonclosure group and has reached the statistically significant level. Due to all these factors the duration of hospital stay is reduced significantly and is of statistical significance. So our study conclude that leaving the peritoneum unsutured is beneficial in terms of above mentioned parameters.

INTRODUCTION

Acute appendicitis remains a most common surgical emergency and appendectomy is a common surgical procedure but has many challenges attached to it.[1] During Emergency open appendectomy following appendectomy it is a standard practice to close the peritoneum.[2] Peritoneum is mesenchymal in origin and unlike epidermis which heals from the borders peritoneum heals throughout the site and it reperitonises within 48-72 hours and complete healing occur within 5-6 days,[3] so closing the peritoneum using sutures doesn't provide any additional advantages but rather evoke adverse responses like adhesion formation and increased post operative pain which are attributed to the trauma and

ISSN (O): 2687-5365; ISSN (P): 2753-6556

ischemia created to peritoneum while suturing which causes an inflammatory sequale which is responsible for the above mentioned complications of peritoneal closure. Obstetric and gynaecological studies have proven that peritoneal closure has no extra advantage.[4] The effect of peritoneal closure using sutures on postoperative pain have been a less ventured domain, which our study intends to address by measuring the analgesic requirement in both groups and comparing them and analysing the data to find out whether the peritoneal closure has any effect on post operative pain.

Aims and Objectives

- Determine the effect of Peritoneal closure versus non closure on post operative analgesia requirement in cases of acute appendicitis undergoing emergency open appendectomy in a tertiary care centre.
- To compare post operative analgesia among patients with peritoneal closure vs non closure in emergency open appendectomy.
- To evaluate its effect on
  - Duration of hospital stay
  - Operative time
  - Additional analgesia requirement
  - Post operative wound infection.

MATERIALS AND METHODS

Source of Data: The data for this study is sourced from patients undergoing emergency open appendectomy in Kanyakumari Government Medical college hospital during April 2021 to October 2022.

Method of Collection of Data:

This study comprises of population of 100 patients admitted with a diagnosis of Acute Appendicitis and planned for Emergency open appendicectomy in Kanyakumari Government Medical College Hospital. Diagnosis of acute appendicitis is arrived with the help of Routine history taking, physical examination and investigations and confirmed with the help of CECT Abdomen.

- Informed written consent and Ethical committee approval will be taken prior to the study.
- Randomisation will be done using Lot system, Lots containing 1-100 number are kept and will be picked in random, patients allotted even number will go to Group A and those who are allotted odd number get assigned to Group B
- After appendectomy the peritoneum will be closed in Group A and left open in Group B Rest of the layers will be closed as per standard practice.
- The patients enrolled for the study undergo open appendicectomy under spinal anaesthesia. Mcburneys incision will be employed in all the cases. Intra operative findings will be noted and patients with complications like haemorrhage, additional pathology detected intra operatively, anaesthetic complication, drug reaction, requirement of mechanical ventilation, anaphylaxis and who need additional procedure or intensive care will be excluded.
- Post operatively Standard analgesia will be given to both groups and pain will be recorded using visual analogue scale (VAS) on day 0, day 1 and day 3.
- Standard analgesia include twice daily intramuscular administration of Diclofenac sodium dose of 75mg.
- Additional analgesia requirement is any additional analgesia given in addition to the above mentioned standard analgesia in form of acetaminophen or opiods.
- Post Operative wound infection is noted.
- Duration of stay in hospital is noted.

Operative Procedure: Patient in supine position with all sterile aseptic precautions in place, parts painted from nipple level till midthigh level. Mcburney's incision is employed in all cases included in the study and incision is deepened, skin followed by subcutaneous tissues (Scarpa and Campers fascia) are opened. External oblique aponeurosis is exposed and along the direction of the fibres the aponeurosis is opened. Internal oblique muscle is identified, muscle splitting done at the Musculo aponeurotic junction, the splitting is continued till the peritoneum is reached. Peritoneum held using straight artery forceps and after ensuring and taking care no bowel comes in the way the peritoneum is opened. Now the appendix is searched, any pus or exudate is drained. If the appendix is identified and found to be inflamed and after ruling out all exclusion criterias proceeded with appendectomy.

Figure 1: Peritoneum being closed Group A

Figure 2: Closed peritoneum Group A

If any of the mentioned exclusion criteria is met the patient will be excluded from the study. The mesoappendix with its blood bessels are either ligated or cauterised. Appendectomy done after transfixation

ISSN (O): 2687-5365; ISSN (P): 2753-6556

using 2'0 polygalactin(Vicryl) and double ligated with 2'0 silk. Specimen is sent for HPE. Now if the patient belongs to Group A, the cut peritoneal layers are held using straight artery forceps and sutured using 2'0 polygalactin(Vicryl). If the patient belongs to Group B the peritoneum is not closed and left open. After the above mentioned two steps the surgery is proceeded and internal oblique muscle layer is closed using 2'0 polygalactin(Vicryl) in horizondal matress fashion. External oblique aponeurosis closed using 2'0 Polygalactin(Vicryl) in continuous non locking fashion. Subcutaneous tissues approximated using 2'0 Polygalactin(Vicryl) in inverted simple sutures. Skin closed using 2'0 Ethilon in matress fashion, sterile dressing done. Post operatively orals started based on bowel sounds and passage of flatus and exclusion criteria if so met the patient is excluded from the study.

Figure 3: Peritoneum defined Group B

Figure 4: Peritoneum not closed Group B

Selection Criteria

Inclusion Criteria

1. Patients with Confirmed Diagnosis of Acute Appendicitis using CECT Abdomen and other supportive investigations
2. Patient undergoing Emergency open appendectomy under spinal anaesthesia
3. Age Group 14-65 years.

Exclusion Criteria

1. Pregnancy
2. Previous intra-abdominal surgeries
3. Immunocompromised patients
4. Patients with Co morbidities like Diabetes, Hypertension, Malignancies, CAD and CVA.
5. Appendicular Mass and Perforated appendix.
6. Patients with intra operative and post operative complications like Haemorrhage, prolonged ileus, faecal fistula, HPE turning malignancy.

RESULTS

The mean age in the closure group was 26.10 ± 9.45, and in non-closure group was 26.32 ± 10.09. There is no significant difference in the age between groups (p=0.911).

Among 50 patients, in the closure group, the female was 20 (40%), and the male 30 (60%). In the non-closure group, the female was 14 (28%), and the male was 36 (72%). There is no significant difference in gender between groups (p=0.205).

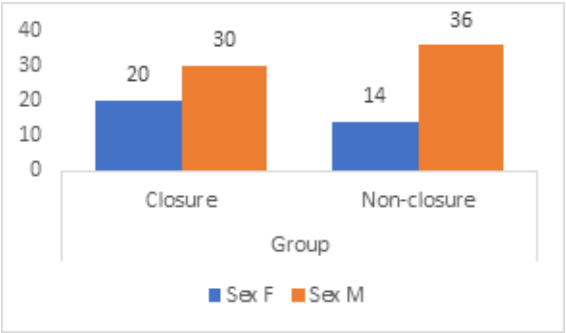

Figure 5: Distribution of Gender

The duration of the procedure in the closure was 48.04 ± 4.16, and in non-closure was 32.74 ± 4.44. There is a significant difference in the duration of the procedure between groups (p=<0.0001).

Table 1: Mean age between groups

Group		Mean	Std. Deviation	P value
Age	Closure	26.10	9.45	0.911
	Non-closure	26.32	10.09	

Table 2: Mean duration of procedure between groups

Group		Mean	Std. Deviation	P value
Duration of procedure (Mins)	Closure	48.04	4.16	<0.0001
	Non-closure	32.74	4.44	

Table 3: VAS score between group

Group		Mean	Std. Deviation	P value
VAS DAY 0	Closure	7.72	0.70	<0.0001
	Non-closure	5.60	0.64	
VAS DAY 1	Closure	4.68	1.02	<0.0001
	Non-closure	3.12	0.72	
VAS DAY 3	Closure	1.86	0.61	<0.0001

ISSN (O): 2687-5365; ISSN (P): 2753-6556

	Non-closure	1.30	0.46	

The mean VAS score at day 0 was 7.72±0.70 in closure group and 5.60±0.64 in non-closure group. There is a significant difference in VAS score on day 0 between groups (p=<0.0001). The mean VAS score at day 1 was 4.68±1.02 in closure group and 3.12±0.72 in non-closure group. There is a significant difference in VAS score on day 1 between groups (p=<0.0001). The mean VAS score at day 3 was 1.86±0.61 in closure group and 1.30±0.46 in non-closure group. There is a significant difference in VAS score on day 3 between groups (p=<0.0001).

Post-op wound infection in the closure group was 5 (10%), and in the non-closure group was 2 (4.0%) of patients. There is no significant difference in post-op wound infection between groups (p=0.24).

Table 4: Distribution of post-op wound infection between groups

			Group		Total	P value
			Closure	Non-closure		
Post op Wound infection	NO	Count	45	48	93	0.24
		% within Group	90.0%	96.0%	93.0%	
	YES	Count	5	2	7	
		% within Group	10.0%	4.0%	7.0%	
Total		Count	45	48	100	
		% within Group	100.0%	100.0%	100.0%	

Additional analgesia requirement in the closure group was 9 (18%), and in the non-closure group was 2 (4%) of patients. There is a significant difference in additional analgesia requirements between groups (p=0.025).

The duration of hospital stay in the closure group was 5.36 ± 0.80, and in the non-closure group was 4.38 ± 0.64. There is a significant difference in the duration of hospital stay between groups (p=<0.0001).

Table 5: Distribution of additional analgesia requirement between

			Group		Total	P value
			Closure	Non-closure		
Additional analgesia requirement	NO	Count	41	48	89	0.025
		% within Group	82.0%	96.0%	89.0%	
	YES	Count	9	2	11	
		% within Group	18.0%	4.0%	11.0%	
Total		Count	50	50	100	
		% within Group	100.0%	100.0%	100.0%	

Table 6: Mean duration of hospital stay between groups

Group		Mean	Std. Deviation	P value
Duration of Stay in Hospital	Closure	5.36	0.80	<0.0001
	Non-closure	4.38	0.64	

DISCUSSION

Historical evidence of nonclosure of peritoneum during open appendectomy can be dated back to 1939, Warren et al8 demonstrated non closure of peritoneum as a method of drainage of appendicular abscess. Leon et al,[12] studied various causative factors for peritoneal adhesions in patients undergoing laparotomy and one among them is excessive use of suture materials intra abdominally. Obstretic evidences,[9-11] has showed non closure of peritoneum during caesarian section doesn't result in increased rate of postoperative wound infection and pain.

Khan et al,[13] in their study proved that adhesions and small bowel obstructions are more common with the intraabdominal suture material used in hernioplasty. Kapur et al,[5] in their study showed that non-closure of peritoneum is less time consuming in laparotomies. Hugh et al in their study showed that non-closure of peritoneum in midline surgeries is quicker, less costly and safer than closure of peritoneum. Wang et al,[7] showed less operating time associated with nonclosure of peritoneum in patients undergoing hysterectomy indicating less anaesthesia exposure which is an important consideration in modern surgery. Moreover the operation time, febrile duration and antibiotic requirements were reduced with nonclosure of peritoneum.

Hajseidjavadi et al,[6] showed that the trend for analgesia requirement and wound infection tended to favour non-closure during caesarian section, There was improved short-term postoperative outcome if the peritoneum was not closed. Gurusamy et al,[14] conducted a review of five randomized control trials in non obstretic midline laparotomy cases and showed that the nonclosure of peritoneum was not associated with increased risk of burst abdomen, incisional hernia. Though the studies involving obstretic procedures provide statistically significant results on post operative analgesia requirement and lot of studies studying various parameters in relation to nonclosure of peritoneum is done but the challenges associated with nonclosure of peritoneum

ISSN (O): 2687-5365; ISSN (P): 2753-6556

in inflammatory conditions like appendicitis remained an enigma.

Our study aimed at identifying the effect of Non closure of peritoneum in open appendectomy in terms of post operative analgesia requirement, VAS scores, duration of procedure, duration of hospital stay and post op infection on comparing with closure of peritoneum.

Demographic Parameters

Age: The mean age in closure group was 26.10 with a Standard deviation of 9.45, the mean age in nonclosure group was 26.32 with a standard deviation of 26.32 with a standard deviation of 10.09. In our study 80 of the total 100 patients were below 30 years of age. 71 of total 100 patients were in the range of 15 years to 30 years and the mean age between the groups were comparable. Suresh et al,[15] in their study on effect of peritoneal closure on post operative analgesia during open appendectomy with inclusion, exclusion criteria similar to our study had a mean age of 25.8 in closure group and 24.6 in nonclosure group which is comparable to our study.

Gender: In our study of the total n=100, female were 34%(n=34) and male were 66%(n=66). In the closure group(n=50) female were n=20 which constitutes 40% within the group and male were n=30 which constitutes 60% within the group. Similarly in the non-closure group, the female was 14 (28%), and the male was 36 (72%). There is no significant difference in gender between groups (p=0.205). The male to female ratio of closure group was 1.5:1 and of the nonclosure group was 2.6:1, which was in similar terms of male predominance in incidence of acute appendicitis in matching with the study by Martin LC et al.[16]

Duration of procedure: The operative time of open appendectomy in the closure group had mean value pf 48.04 with standard deviation of 4.16 and in the nonclosure group the operative time had a mean duration of 32.74 with a standard deviation of 4.44. In the study conducted by suresh et al,[15] the mean operative time was 37 in closure group and 31 in nonclosure group with a difference of 6 minutes between closure and nonclosure, but our study had a difference in operating time between the two groups as 16 minutes which is statistically significant with a p value of <0.0001.

Wilkinson et al,[17] conducted a prospective comparative study of 126 patients regarding closure and nonclosure of peritoneum during open appendectomy in terms of operative time, post operative period for pain using VAS scores, wound infections and duration of hospital stay. The study was a non randomised study with (n=59) in closure group and (n=67) and found that only operative time was reduced in a statistically significant way(p<0.001), which was comparable with our study. As the surgical time taken varies from surgeon to surgeon and since in the present study this pool consisted of more than 15 qualified surgeons operating, the duration of surgery may not be clearly interpreted. However, since non-closure involves one less step in surgical procedure, probably operating time taken would be less as demonstrated by our results.

Post operative Pain: In the study by suresh et al,[15] on post operative analgesic requirement in open appendectomy in terms of peritoneal closure vs non closure the Visual analogue score on Day 0 had a mean value of 52.52±8.54 in closure group and a mean value of 44.34±7.44 which was statistically significant p<0.001. The mean visual analogue score on Day 1 was 40.04±5.98 in closure group and 37.36±5.79 with a p value of <0.05. The mean Visual analogue score on Day 2 was 32.54±4.92 in closure group when compared to nonclosure group which was 28.21±5.043 with p value of <0.0.5. Thus this study had a finding of significantly less post operative pain when the peritoneum was left unclosed in open appendectomy.

Our study also had similar finding comparable to the above study, The mean Visual analogue score at day 0 of our study was 7.72±0.70 in closure group and 5.60±0.64 in non-closure group(p<0.0001). The mean Visual analogue score at day 1 was 4.68±1.02 in closure group and 3.12±0.72 in non-closure group(p<0.0001). The mean Visual analogue score at day 3 was 1.86±0.61 in closure group and 1.30±0.46 in non-closure group(p<0.0001). The Post operative pain was significantly reduced when the peritoneum was not sutured when compared to suturing the peritoneum.

Huseyin Kazim Bektasoglu et al,[18] conducted a study on effect of Nonclosure of peritoneum on post operative analgesia requirement in open appendectomy and the median VAS score was lower in the open peritoneum group(median=3) when compared with closed peritoneum group(median=4) but without any statistical significance(p<0.134). Though statistically not significant, it was clearly evident in the study that the post operative pain was less in the nonclosure group. But our study had statistically significant reduction of postoperative pain when the peritoneum was left unsutured. We emphasise the fact Not suturing the peritoneum during open appendectomy has beneficial effects on post Post operative pain.

Additional Analgesia Requirement: In our study 9(18%) of patients in the closure group and 2(4%) of patients in nonclosure group required additional analgesic requirement with a statistically significant p value of 0.025. Vijaykumar Kappikeri et al,[19] conducted a study on additional analgesic requirement in open appendectomy in terms of peritoneal closure and non closure. Among the total subjects, 134(67%)required standard analgesics following surgery and 66 (33%) showed higher requirement of analgesics. Among the subjects who required only standard analgesics, majority (56%) of them had non-closure of peritoneum. Those who required high analgesic requirement, majority(41%) are in closure of peritoneum group. Our study had similar findings of the above study and in accordance with the perception on pain on Visual analogue score

ISSN (O): 2687-5365; ISSN (P): 2753-6556

as described above we conclude that non closure of peritoneum during open appendectomy have lesser postoperative pain and lesser analgesic requirement.

Post op Wound infection: Our study had a post operative wound infection in 5 patients(10%) in the closure group and 2 patients(4%) in the non closure group, but the values were statistically not significant with a p value of 0.24. Wilkinson et al,[17] in their study, Wound infection was found in 4 patients in closure group and 3 patients in nonclosure group and was statistically non-significant which is in terms with our study finding. The wound infection were comparable between the two groups in our study and hence we emphasise that post operative wound infection doesn't increase with leaving the peritoneum open.

Duration of Hospital stay: The duration of hospital stay in the closure group was 5.36 ± 0.80, and in the non-closure group was 4.38 ± 0.64. There is a significant difference in the duration of hospital stay between groups (p=<0.0001). Wilkinson et al,[17] found the mean duration of hospital stay in closure group was 6.33 days and nonclosure group was 5.92 days. This difference was found to be statistically significant (p-value <0.0081). Our findings were similar to the above mentioned study and the duration of hospital stay was significantly reduced when we leave the peritoneum open without suturing during open appendectomy.

Limitations

- In our present study the limitations include shorter follow up period but a longer follow up period is required to study any possible long term complications like incisional hernia and adhesions due to nonclosure of peritoneum.
- Another limitation of this study is the incision length which was not evaluated due to the lack of information on the proportion of the incision length to the abdominal morphology.
- Parameter like quality of life linked with post operative pain was not studied in detail in the present study.

CONCLUSION

Our study demonstrates that nonclosure of peritoneum in emergency open appendectomy is associated with less post operative pain, less additional analgesic requirements, shorter duration of procedure, shorter hospital stay. Our study also proves the fact that non closure of peritoneum is not associated with increased risk of wound infection. We conclude that non closure of peritoneum during open appendectomy can be preferred as it is associated with statistically significant reduction of post operative pain.

REFERENCES

1. Prystowsky JB, Pugh CM, Nagle AP. Current problems in surgery. Appendicitis. Curr Probl Surg. 2005;42:688–742.
2. In: Brunicardi F, Andersen DK, Billiar TR, Dunn DL, Kao LS, Hunter JG, Matthews JB, Pollock RE. eds. Schwartz's Principles of Surgery, 11e. McGraw Hill; 2019:1336.
3. Shapiro L, Holste JL, Muench T, diZerega G. Rapid reperitonealization and wound healing in a preclinical model of abdominal trauma repair with a composite mesh. Int J Surg. 2015 Oct;22:86-91. doi: 10.1016/j.ijsu.2015.06.071. Epub 2015 Jul 9. PMID: 26166739.
4. Kurek Eken M., Örek E., Tarhan T., et al. Effects of closure versus non-closure of the visceral and parietal peritoneum at cesarean section: does it have any effect on postoperative vital signs? A prospective randomized study. Journal of Maternal-Fetal & Neonatal Medicine. 2017;30(8):922–926. doi: 10.1080/14767058.2016.1190826. [PubMed] [CrossRef] [Google Scholar].
5. Kapur ML, Daneswar A, Chopra P. Evaluation of peritoneal closure at laparotomy. Am J Surg 1979;137:650-2.
6. Hajsedvadi ES, Rasekh F. Post-caesarean pain in closure versus nonclosure of parietal peritoneum. The Journal of Qazvin Univ. of Med. Sci 2006;10:45-8.
7. Xiong Z,Dong W, Wang Z. Non-closure of the peritoneum and subcutaneous tissue at radical hysterectomy:A Randomized controlled trial. Front Med China 2010; 4: 112-6.
8. R. Warren, "Primary closure of peritoneum in acute appendicitis with perforation:report of twenty cases," Annals of Surgery, vol. 110, no. 2, pp. 222–230, 1939.
9. A. Takreem, "Comparison of peritoneal closure versus nonclosure during caesarean section," Journal of Ayub Medical College Abbottabad, vol. 27, no.1,pp. 78–80, 201.
10. V. Kapustian, E. Y. Anteby, M. Gdalevich, S. Shenhav, O. Lavie, and O. Gemer, "Effect of closure versus nonclosure of peritoneum at cesarean section on adhesions: a prospective randomized study," American Journal of Obstetrics Gynecology,vol. 206, no. 1, pp. 56.e1–56.e4, 2012.
11. Y. Komoto, K. Shimoya, T. Shimizu et al., "Prospective study of non-closure or closure of the peritoneum at caesarean delivery in 124 women",Journal of Obstetrics and Gynaecology Research, vol. 32, no. 4, pp. 396–402, 2006.
12. C. J. Leon, N. A. Gomez, and S. A. Iñiguez, "Suturing of the peritoneum during abdominal wall closure after laparotomy," World Journal of Surgery, vol. 18, no. 2, p. 292, 1994.
13. F. A. Khan, A. Hashmi, and D. A. Edelman, "Small bowel obstruction caused by self-anchoring suture used for peritoneal closure following robotic inguinal hernia repair," Journal of Surgical Case Reports, vol. 2016, no. 6, Article ID rjw117, 2016.
14. K. S. Gurusamy, E. Cassar Delia, and B. R. Davidson, "Peritoneal closure versus no peritoneal closure for patients undergoing non-obstetric abdominal operations," Cochrane Database of Systematic Reviews, vol. 4, no. 7, article CD010424, 2013.
15. B. Suresh, U. Ambi, G. Anilkumar, E. Shaileshl, and Y. Lamani, "Post-operative analgesic requirement in nonclosure and closure of peritoneum during open appendectomy-randomized controlled study," Journal of Clinical and Diagnostic Research, vol. 6, no. 2, pp. 264–266,2012.
16. Martin LC, Puente I. Open versus laparoscopic appendicectomy: a prospective randomized comparision. Ann Surg. 1995;222(3):257.
17. Wilkinson, T. R., Mahendra K. Chauhan, & Isha Trivedi. "Peritoneal closure or non-closure in open appendectomy: a reality or a myth." International Surgery Journal [Online], 5.9 (2018): 3102-3106. Web. 14 Nov. 2022.
18. Bektasoglu HK, Hasbahceci M, Yigman S, Yardimci E, Kunduz E, Malya FU. Nonclosure of the Peritoneum during Appendectomy May Cause Less Postoperative Pain: A Randomized, Double-Blind Study. Pain Res Manag. 2019 May 23;2019:9392780. doi: 10.1155/2019/9392780. PMID: 31249637; PMCID: PMC6556235.
19. Kappikeri, Vijaykumar, and Manjunath Meti. "A Comparative Study Between Closure and Non-closure of Peritoneum During Appendicectomy." RGUHS Journal of Medical Sciences, 1 Jan. 2019, journalgrid.com/view/article/rjms/231.

ISSN (O): 2687-5365; ISSN (P): 2753-6556