e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2026; 18(4); 1577-1582

Original Research Article

Per-Operative Fascial Swab Culture as a Predictor of Post-Operative Wound Infection in Open Appendectomy

John Lalliandinga[1], Zothansangi[2], Lalnuntluanga Sailo[3], Lalhruaitluanga[4]

[1]Professor & Head, Department of Surgery, Zoram Medical College & Hospital. Mizoram, India
[2]Associate Professor, Department of Pathology, Zoram Medical College & Hospital. Mizoram, India
[3]Associate Professor & Head, Department of Respiratory Medicine, Zoram Medical College & Hospital, Mizoram, India
[4]Assistant Professor, Department of Surgery, Zoram Medical College & Hospital, Mizoram, India

Received: 22-02-2026 / Revised: 23-03-2026 / Accepted: 25-04-2026
Corresponding Author: Zothansangi
Conflict of interest: Nil

Abstract:

Background: Post-operative wound infection remains a significant complication following open appendectomy and contributes to prolonged hospital stay and increased healthcare burden. The identification of bacterial contamination at wound closure and the prediction of eventual surgical site infection (SSI) may be aided by per-operative fascial swab culture. In patients having an open appendectomy, this study assessed the predictive value of fascial swab culture for post-operative wound infection.

Methods: A prospective clinical study was conducted in the Department of Surgery, Zoram Medical College & Hospital, Mizoram, India, from January 2025 to February 2026. Fifty patients undergoing emergency open appendectomy for acute appendicitis were included. Before the skin was closed, fascial wound swabs were taken and put through sensitivity testing and microbiological culture. For thirty days, patients were watched for the emergence of wound infections following surgery. The Chi-square/Fisher exact test was used for statistical analysis, and $p < 0.05$ was deemed statistically significant.

Results: Among 50 patients, 33 were males and 17 were females, with the majority belonging to the 21–30 years age group. Acute uncomplicated appendicitis was observed in 32 patients, while 18 had complicated appendicitis. Fascial swab culture showed no bacterial growth in 60% cases, enteric organisms in 26%, and cutaneous organisms in 16%. *Escherichia coli* was the most commonly isolated enteric organism (16%). Surgical site infection developed in 10 patients (20%). Wound infection was significantly associated with positive fascial swab culture for *E. coli* ($p = 0.041$). Enteric organisms were significantly more common in complicated appendicitis ($p = 0.001$). Culture-negative wounds demonstrated a lower incidence of post-operative infection compared to culture-positive wounds.

Conclusion: A good indicator of post-operative wound infection after an open appendectomy is the per-operative fascial swab culture. A markedly increased risk of a subsequent wound infection is linked to the isolation of enteric microbes, especially E. coli. Therefore, fascial swab culture may help identify patients at high risk and direct suitable post-operative care techniques.

Keywords: Post-Operative, Wound, Infection, Fascial Swab, Culture-Positive Wounds.

DOI: 10.25258/ijcpr.18.4.248

Introduction

A persisting problem in colorectal surgery is the occurrence of wound infections, with infection rates following laparotomy of 10-15% [1]. Wound infection prolongs healing and increases the risk of poor cicatrisation, the duration of hospitalization, and the subsequent costs of medical care [2-4]. Prevention of wound infection in elective open colorectal surgery includes antibiotic prophylaxis and mechanical bowel preparation. The advantages of the latter approach has been a content of debate [5].

The highest wound infection rate in abdominal surgery probably occurs following colorectal procedures. Ist has been suggested that there is an increased bacterial load before wound closure following colorectal surgery in comparison with other abdominal operations. [7-8]

It has been a traditional practice to take microbiological swabs for culture during appendectomy. This is an expectation that identification of organisms and knowledge of their

sensitivities will guide selection of the most suitable antibiotic regimen and reduce the morbidity [9].

There are studies, however which questioned the merit of this practice. Indeed, it would appear that many clinicians use antibiotic therapy in an empirical fashion that is not influenced by the results of intra-operative cultures [10]. Maj Gregory et al in their study of 608 patients who underwent appendectomy and intra-operative culturing during appendectomy concluded that positive cultures were only weakly predictive of post-operative infection, and culture did not influence selection of antibiotics, and discouraged the use of intra-operative culturing, regarded it costly and unnecessary, except in patients at high-risk [11].

The use of fascial swabs taken during surgery, rather than intra-peritoneal swabs, however has its own value as predictor for assessing the risk of subsequent post-operative wound infection. It has been suggested that swabs taken from the subcutaneous fat after fascial closure may be the best method of detecting organisms likely to cause a subsequent abdominal wound infection [13,14]. Organisms involved in infections following colorectal surgery are mainly endogenous microorganisms such as E. Coli, B. fragilis, Proteus spp. And Klebsiella spp[15,17]. It seems that contamination of the wound with colonic flora during surgery may cause a polymicrobial infection caused by commensals and other potentially pathogenic microorganisms.

Studies underlined the importance of bacteriological analysis of wounds at the end of operation in identifying those at risk of post-operative infection and the probable causative pathogenic organisms. Thus, the predilection of wound infection with demonstrable microbial growth on the fascia, culture being taken at closure of the sound subsequently alter the peri-operative management of appendectomy patients. The study is aimed at determining the accuracy of fascial swab culture at wound closure as a predictor of post-operative wound infection, bacteriological study and their individual association with wound infection, and to explore the potentiality of utilizing the subsequent data for managing post-operative wound (both local and systemic care).

Materials and Methods

This study was carried out in the department of Surgery (Pediatric Surgery Unit) in the Zoram Medical College & Hospital, Falkawn, Mizoram, India, during the period of 1 year from January 2025 to February 2026. A prospective clinical study consisting of 50 patients who underwent open appendectomy was undertaken to study the relationship of per-operative fascial swab culture and incidence of post-operative wound infection in culture positive cases. Our study was approved by our Institution's Ethics Review Committee.

All patients who underwent Emergency Open Appendectomy for suspected acute appendicitis during the period from 1st January 2025 to 28th February 2026 were included in the study. Exclusion criteria being patients who underwent interval appendectomy during this same period because they are not comparable to appendectomies due to aute appendicitis, in terms of the degree of infective pathology and their potential for contamination. Similary, patients who had incidental appendectomies were excluded due to the possibility of bacterial contamination from a separate source other than the appendix operation. Patients who required peritoneal drains were also excluded in the study. On admission, detailed history of present and past illnesses, presence or absence of co-morbid illnesses like Cardiovascular, Respiratory, Renal Diseases or Diabetes Mellitus were recorded. Detailed physical examination and relevant hematological/ biochemical and serological investigations were assessed in each patient. Diagnosis of acute appendicitis were largely based on clinical grounds.

Following pre-operative resuscitation with appropriate intravenous fluids, a single dose of intravenous Ceftriaxone 1 gram and metronidazole 500 mg were given after allergic sensitivity tests. During the operation, degree of peritoneal contamination was assessed, a polyglactin (vicryl) 2-0 was used to transfix the base of appendix and the same suture used for closure of the internal oblique and external oblique muscles. Before closure of skin with Skin Staples, culture of deep fascia wound swab was taken and sensitivity pattern obtained at 48 hours by standard disc-diffusion method. Any resistant organism to first line antibiotics was noted down separately. Post-operative antibiotics was continued with injection Ceftriaxone 1 gram 12 hourly and injection metronidazole 500 mg 8 hourly for 24 hours in case of acute uncomplicated appendicitis. This was extended to 5 days in case of perforated appendicitis. Oral route was initiated as soon as patient resumed normal intake.

Post-operative progress was closely monitored for development of wound infection, respiratory tract infection, septicemia, organ failure and other complications. Surgical site infection was considered anytime from 0-30 days after the operation and patient being followed up either as in-patient or as an out-patient during the stipulated time period. Duration of hospital stay was recorded in each patient. The collected data was analysed for evaluation of presence of bacterial contamination at contamination, and development of subsequent infection, and if there was bacterial growth, comparison of enteric organisms or cutaneous organisms-each association with post-operative

wound infection. Incidence of infection was studied between acute and complicated (perforated/gangrenous) appendicitis, male and female, age group, and patients with co-morbid illnesses. Subsequent swab cultures were sent if there was wound infection.

Results

A prospective surgical study consisting of 50 patients with open Appendectomy was undertaken. Results on continuous measurements were presented on Mean ± SD (Min- Max) and results on categorical measurements were presented in Number (%). Significance was assessed at 5% level of significance. Chi-square test/ Fisher Exact test has been used to find the significance of post-op wound infection in association with Fascial Swab culture findings. 90% confidence interval has been computed in the study. Statistical software namely SPSS 15.0, Stata 8.0, Med Calc 9.0.1 and Systat 11.0 were used for the analysis of the data. There were 33 males and 17 females included in the study with a Mean ±SD of 26.12 ±11.58 AND 29.00 ± 11.88 respectively. Age distribution was found to be maximum between the age of 21-30 years (21%), followed by patients under the age of 21, and notably less number of patients above 50 years (4%). Acute non-complicated appendicitis comprised of 32 numbers whereas complicated appendicitis (gangrenous/ perforated/local pus collection and generalized peritonitis and abscess) comprised of 18 patients. The mean duration of hospital stay was 3.84 ± 1.28 days. The older age group (>50 years) had higher incidence of complicated appendicitis ie, 100%, as against the younger age group (<21 years) ie, 21.4 %. In this study, the incidence of complicated appendicitis were found to be higher in male (42.4%) against their female counterparts (23.5%). Out of the fascial swab culture taken in all 50 patients, 30 (60%) did not yield any growth on incubation. Enteric organisms grew in 13 cases (26%) with E.coli being the predominant bacteria ie, 8 numbers (16%) and cutaneous organisms found in 8 patients fascial swab samples (16%), as shown in Table 1:

Table 1: Fascial swab culture

Fascial Swab culture	Number (n=50)	%
No growth	**30**	**60.0**
Enteric	**13**	**26.0**
E. Coli	8	16.0
Psudomonas	2	4.0
Atypical E. Coli	1	2.0
Enterococci	2	4.0
Cutaneous	**8**	**16.0**
Coagulase negative staph	6	12.0
Micrococci	1	2.0
MSSA	1	2.0

Out of the 30 patients with negative growth in fascial swab culture 22 patients (68.8%) were from the Acute uncomplicated appendicitis group whereas 8 patients (44.4%) were from the complicated appendicitis group, with a p value of 0.092+. E. Coli was grown maximum in complicated appendicitis- 6 nos. (33.3%) as against uncomplicated appendicitis – 2 nos. (6.3%). The association of fascial swab culture growth with the type of appendicitis is shown in Table 2.

Table 2: Fascial swab culture and its association with type of appendicitis

Fascial Swab culture	Number (n+50)	Type of appendicitis		P value
		Acute (n=32)	Complicated (n=18)	
		No (%)	No (%)	
No growth	30 (60.0%)	22 (68.8%)	8 (44.4%)	0.092+
Enteric	13 (26.0%)	3 (9.4%)	10 (55.6%)	0.001**
E.Coli	8 (16.0%)	2 (6.3%)	6 (33.3%)	0.017*
Pseudomonas	2 (4.0%)	1 (3.1%)	1 (5.6%)	1.000
Atypical E. Coli	1 (2.0%)	0	1 (5.6%)	0.353
Enterococci	2 (4.0%)	0	2 (11.1%)	0.120
Cutaneous	8 (16.0%)	7 (21.8%)	1 (5.6%)	0.233
Coagulase negative staph	6 (12.0%)	6 (18.8%)	0	0.078+
Micrococci	1 (2.0%)	1 (3.1%)	0	1.000
MSSA	1 (2.0%)	0	1 (5.6%)	0.353

The association of gangrenous appendicitis was seen most with E. Coli (3 nos. ie, 37.5%). Notably, cutaneous organisms were not seen in fascial swab culture of those with gangrenous appendicitis. Likewise, E. Coli was grown maximum in cases with local pus collection (3 out of 11 ie, 25%).

Following operation, patients were carefully monitored for any sign of Surgical Site Infections (SSIs), and closely followed for 30 days following discharge from the hospital as out-patient basis, if there were no documented wound infection during the hospital stay. There were 10 cases of surgical site infections out of the 50 cases.ie 20%. 3 cases did not have any growth on fascial swab culture despite the SSIs. E. Coli was grown in 4 cases, Pseudomonas - 1 no, and Coagulase negative Staph – 2nos. respectively, as shown in Table 3 below.

Table 3: Fascial Swab culture and its association with post-operative wound infection

Fascial Swab culture	Number (n+50)	Post-op wound infection		P value
		Absent (n=40)	Present (n=18)	
		No (%)	No (%)	
No growth	30 (60.0%)	27 (67.5%)	3 (30.0%)	0.067+
Enteric	13 (26.0%)	8 (20.0%)	5 (50.0%)	0.101
E.Coli	8 (16.0%)	4 (10.0%)	4 (40.0%)	0.041*
Pseudomonas	2 (4.0%)	1 (2.5%)	1 (10%)	0.363
Atypical E. Coli	1 (2.0%)	1 (2.5%)	0	1.000
Enterococci	2 (4.0%)	2 (5.0%)	0	1.000
Cutaneous	8 (16.0%)	6 (15.0%)	2 (20.0%)	0.653
Coagulase negative staph	6 (12.0%)	4 (10.0%)	2 (20.0%)	0.586
Micrococci	1 (2.0%)	1 (2.5%)	0	1.000
MSSA	1 (2.0%)	1 (2.5%)	0	1.000

The duration of hospital stay was statistically similar between the two groups- absent or present post-operative wound infections with P=0.704, with a mean of 3.84±1.28 days

Discussion

In this study of 50 patients operated for appendicitis, the age distribution was found to be maximum between the age of 21-30 years (21%), and notably less number of patients above 50 years (4%). The number of females are just half the number of males, which accounts for 34%, showing a relative increase incidence of acute appendicitis among males according to the study. None of the patients included in the study had surgical or medical complications, which is perhaps due to the relatively younger age group seen in the study.

The distribution of acute appendicitis and complicated appendicitis are 64% versus 36% with gangrenous or perforated appendicitis. Only 2% of them have generalized peritonitis or diffuse intra-peritoneal abscess. In this study, the overall yield in fascial swab culture was 40% where the remaining 60% had negative growth in the culture swab. Among the 40% with positive growth, 26% were of enteric organisms, with E. Coli being the predominant organism with 16%, followed by Pseudomonas (4%). This is consistent with other studies. Cutaneous organisms accounted for 16 % of the growth, with Coagulase negative staphylococcus being the maximum (12%).

In this study, the overall incidence of wound infection was remarkably low, with only 10 patients developing documented wound infection. Here patients were followed for 30 days following discharge from the hospital as out patient basis. The following criteria was employed for presence or absence of surgical site infection- purulent discharge, organisms isolated from fluid/tissue of the superficial incision, at least 1 sign of inflammation (pain or tenderness, induration, local warmth), the wound being deliberately opened by the surgeon after declaring an infection.

The mean duration of hospital stay post-operatively was 3.84 +-1.28 days, majority of them (52%) stayed for 4-7 days in the hospital. In this study, out of 30 patients with negative growth in the fascial swab culture, only 3 patients developed post-operative wound infection, suggesting a significance with a p value of 0.067. Wounds harbouring E. Coli had post-operative infection in 4 cases out of 8, showing a moderate statistical significance (p=0.041). Among the cutaneous organisms, the predominant bacteria yielded being Coagulase negative Staphylococcus, 2 out of 6 colonized wounds developed infections (p=0.586).

It was also noted that the incidence of complicated appendicitis progressively increases with age, where above 50 years, it became 100 % (2/2). The incidence of complicated appendicitis was also found to be more in males (42%) as against females (23%). Coagulase negative Staphylococcus growth in the culture swab was seen only in acute appendicitis. None of the 6 patients whose culture swab had this bacterial growth had complicated appendicitis. This largely explains the origin of the

contaminationg organisms (cutaneous versus enteric).

Finally, in this study, the incidence of post-operative wound infection was obviously low (10%) in culture negative wounds. On the contrary, the incidence peaked with enteric organisms (38%) with E. Coli and Pseudomonas responsible for 50% each of the cases they contaminated. Overall (both enteric and cutaneous), post-operative wound infection was seen in 68% of culture positive wounds. At the same time, 10% of culture negative wounds developed infection.

Conclusion

The degree of fascial wound bacterial contamination at the end of operation is significantly lesser in acute appendicitis compared to complicated appendicitis. Enteric commensals tend to be the most commonly isolated in cases of complicated appendicitis. Among the enteric commensals, E. Coli is the most common organism isolated. The incidence of post-operative wound infection is comparatively low in fascial swab culture negative wounds than that of culture positive wounds. On the other hand, the risk of subsequent development of wound infection is significantly high if enteric organisms, predominantly E.Coli is isolated in fascial swab culture at the time of closure. As a whole, wounds contaminated by cutaneous commensals has less likelihood of developing infection as compared to that of wounds contaminated by enteric pathogens.

From the above inferences, it was be concluded that post-operative fascial swab culture has a good value to study the microbiological profile in appendicitis, and as a predictor of post-operative wound infection.

References:

1. Johnston D.Bowel preparation for colorectal surgery. Br J Surg 1987; 74:553-554
2. Smith M. Enquist I. A quantitative study of the impaired healing resulting from infection. Surg Gynecol Obstet 1967; 125:965
3. Tenorio A, Jindrak K. Accelerated healing in infected wounds. Surg Gynecol Obstet 1976; 77: 537-543.
4. Kapur BM. Role of intraoperative wound contamination in post operative wound infection in laparotomy. Ind J Med Res 1985; 91:508-513.
5. Platell C Hall J. What is the role of mechanical bowel preparation in patients undergoing colorectal surgery? Dis Colon Rectum 1998; 41: 875-883.
6. Keighley MRB. Prevention of wound sepsis in gastrointestinal surgery. Br J Surg 1977; 64: 315-318.
7. Raahave D. Bacterial density in laparotomy wounds during gastro-intestinal operations. Scand J Gastroenterol 1976; 37: 135-142.
8. Nandi PL, Soundara Rajan S. Surgical wound infection. Hong Kong Med J 1999; 5:82-86.
9. March A Gladman, Charles H Knowles, Lucy J Gladman, John G Payne, Intr-operative culture in appendicitis; traditional practice challenged Ann R Coll Surg Engl2004; 86: 196.
10. dale M Mosdell, MD Don M Morris, MD, Donald E. Fry, MD, Peritoneal cultures and antibiotic therapy in Pediatric perforated appendicitis: The American Journal of Surgery 167 March 1994: 31311.
11. Maj Gregory J.Jaffers, MC, USAF, Thomas W. Pollock MD; Intraoperative culturing during surgery for acute appendicitis: Arch Surg Vol 116, July 1981:866.
12. Michael J Mc Namara, MD, Michael D. Pasquale, MD, and Stephen R.T Evans MD, : Acute appendicitis and the use of intraperitoneal cultures.
13. Kippax PW, Thomas ET. Surgical wound sepsis in a general hospital. Lancet 1966: 2: 1297-1300.
14. Polk HC. Post operative wound infection: prediction of some responsible organisms Am J Surg 1973: 126: 592-594
15. Davidson AIG, Smith G. A bacterial study of the immediate environment of a surgical wound. Br J Surg 1971: 58: 326-333.
16. Cruse PJE. A five year prospective study of 23,648 surgical wounds. Arch Surg 1973; 107:206-210.
17. Gorbach SL, Bartlett JG. Anaerobic infections. N Engl J Med 1974: 290: 1177-1184.
18. Saksena DS, Block MA. Bacterioidaceae; anaerobic organisms encountered in surgical infections. Surgery 1968: 63:261-267.
19. Raahave D. New technique for quantitative bacteriological sampling of wounds by velvet pads: clinical sampling trial. J Clin Microbiol 1975: 2: 277-280.
20. P.R. Fa-Si-OEN, F.Kroeze, L.H.M Verhoef, C. Verwaest, R.M.H. Roumen (2005). Bacteriology of abdominal wounds in elective open colon surgery; a prospective study of 100 surgical wounds. Clinical Microbiology and infection 11 (2), 155-157 doi: 10.1111/j. 1469-0691.2004.01011.x
21. Kevin P. Lally M.D. Charles S. Cox JR, M.D, Richard J. Andrassy, M.D. editors. Sabiston text book of surgery. 17th ed. Elsevier; 2004, p. 1382-1383. Ds
22. Bennion RS, Baron EJ, Thompson JE, et al: The bacteriology of gangrenous and perforated appendicitis revisited. Ann Surg 211: 165-171, 1980
23. Lawal OO, Adejuyigbe O, Oluwole SR, The predictive value of bacterial contamination at operation in post operative wound sepsis. Afr J Med Science Sep, 19(3): 173-9

24. Breasted D. The Edwin Smith Surgical Papyrus. University of Chicago. University of Chicago press; 1930.
25. Bryan PW. The Papyrus Ebers. London/Washington DC. Government Printing Office; 1883.
26. Cohen IK. A brief history of wound healing. 1st ed. Yardley, Pa; Oxford Clinical Communications Inc; 1998.
27. Lister J. On a new method of treating compound fractures. Lancet. 1867; 1:326-329.
28. Helling TS, Daon e. In Flanders fields: the Great War Antoine Depage, and the resurgence of debridement. Ann Surg. Aug 1998; 228 (2); 173-81.
29. Centers for Disease Control and Prevention. Prevent antimicrobial resistance in health care settings. Available at: http://www.cdc.gov/ drug resistance/healthcare/problem.htm.
30. National Nasocomial Infections Surveillance (NNIS) System. NNIS report, data summary from October 1986- April 1996, issued May 1996. A report from the NNIS System. Am J Infect Control. Oct 1996; 24 (5): 380-8.