Appendicial Peritonitis in Children: Is the Practice of Routine Intra-operative Peritoneal Cultures Justified?

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Results of intra-operative peritoneal culture swabs were reviewed in 47 children with complicated appendicitis in an attempt to find their correlation with the perioperative antibiotics used empirically. The culture results were positive in 44 patients. E Coli (83%) and Bacteroides spp. (72%) were the most common organisms isolated, followed by Enterococci, Pseudomonas and Klebsiella. The empirical antibiotic therapy (combination of Ampicillin, Gentamycin and Metronidazole followed by single agent, Augmentin) was found to be effective in almost all the patients, as indicated by the sensitivity reports and therapeutic response. The antibiotic therapy was not changed in any patient in the postoperative period. As the bacterial flora of the complicated appendicitis is well documented and the combination antibiotic therapy provides a comprehensive cover for these microorganisms, it is felt that currently, the practice of routine use of peritoneal cultures is not justified and cost effective.

Key Words: Complicated Appendicitis, peritoneal Cultures

Acute appendicitis remains the commonest acute abdominal emergency in paediatrics surgical practice.[1] Complicated appendicitis (gangrenous and perforated) accounts for 30% to 80% of children with appendicitis.[2,3,4,5] Complicated appendicitis is associated with a higher rate of complications, mainly septic ones. Prior to antibiotic era, the incidence of septic complications, ranged from 42% to 83%[6]. However, several recent studies have shown dramatic effects of appropriate antibiotic therapy in reducing the incidence of septic complications. [7,8,9] Generally, it is deemed important to document the bacteria cultured from the peritoneal cavity to guide the surgeon in selection of appropriate antibiotic postoperatively [7]. However, as the efficacy of current antibiotic combinations is well documented, the practice of routine peritoneal cultures is questionable. We reviewed our experience in an attempt to find out whether the results of intraoperative peritoneal cultures have any impact on selection or change of perioperative antibiotic therapy.

Patients and Methods

In this retrospective study, the medical records of 51 patients with complicated appendicitis, admitted to our paediatric surgical unit in London during the period of 1992-1994, were reviewed. Thirty seven patients had a gangrenous while, 14 had a perforated appendix. Age range was 14 months to 15 years, with an equal male to female ratio. Triple antibiotic therapy comprising Ampicillin, Gentamycin and Metronidazole was commenced, once a presumptive diagnosis of complicated appendicitis was made. The clinical criteria on which the diagnosis was made included a delayed presentation high grade fever and diffuse abdominal tenderness.These patients were found to have either local or generalized peritonitis at operation. The culture swabs were obtained immediately after opening the peritoneum. Appendicectomy was performed and the stump burried with a purse- string suture. The right iliac fossa was cleaned in case of localized peritonitis while a thorough peritoneal toilet was performed if generalized peritonitis was present. The skin was closed with subcuticular absorbable sutures. The antibiotic were continued for 5-7 days. However, the intravenous therapy was replaced with orally administered single agent Augmentin (SmithKline & Beecham) once the oral intake was commenced. The therapeutic response was monitored by clinical criteria like body temperature, leukocyte count and return of bowel activity.

Results

Culture reports could be retrieved in 47 patients. The common pathogens isolated were E Coli (83%), Bacteriodes (72%). Enterococci (24%), Pseudomonas (13%) and Klebsiella (9%) (Table 1). The patients may be categorized into four groups:
Group-I: The culture/sensitivity was consistent with the empirical antibiotic therapy in 34 patients.
Group-II Culture was negative in 3 patients.

Group-III Not all the target organisms were found on culture in 8 patients.

Group-IV The culture report was not consistent with the antibiotic therapy in 2 patients. However, both made a complete recovery.

Table 1 Bacteria isolated in various series

Series	Year	E.Coli	Bacteroides	Enterococci	Psuedomonas	Klebsiella
Stone[12]	1976	81	96	30	03	40
Bower et al[15]	1981	85	89	59	20	11
David et al[6]	1982	67	24	50	16	04
Gultierrez et al[9]	1987	77	55	35	22	?
Mackay et al7	1987	82	43	42	23	10
Putnam[16]	1990	59	61	36	14	?
Mosdell et al[14]	1994	66	62	14	?	07
Present study	1996	83	72	24	13	09

All patients recovered completely. No patient developed intra-abdominal abscess. Only three patients.belonging to group I, developed wound infection that ran a benign course after simple drainage on a day case basis. This is an interesting finding ,as all the wounds were closed primarily.

Discussion

Complicated appendicitis is the most common cause of peritonitis in children. Prior to antibiotic era it was associated with a dismal prognosis.[4,10] In recent years, the mortality and morbidity rates have been dramatically reduced by virtue of improved surgical techniques, better understanding of microbiology and evolution of appropriate antibiotics. This is reflected by the fact that the infective complication rate of 42-83% has been reduced to as low as 1-6%.[6]

Gangrenous or perforated appendicitis releases micro-organisms including both aerobes and anaerobes in the peritoneal cavity, resulting in local or generalized peritonitis. The microbiology of appendicial peritonitis was first documented by Altemier in 1938.[11] Since then the polymicrobial nature of the condition has been further confirmed by several other investigators.[12,13,14,15,16] The predominant microbial flora of appendicial peritonitis closely parallels that found in intra-abdominal infection from a perforated viscus[13]. Aerobes like E.Coli, Pseudomonas, Klebsiella, Proteus, Enterococcus and anaerobes like Bacteriodes fragilis are commonly isolated organisms from intra-operative peritoneal cultures (Table-I) These pathogens exist in a state of symbiosis and their synergistic action makes them highly virulent.Various trials have been undertaken in an attempt to find out the optimal antibiotic combinations effective against the known pathogens in appendicial peritonitis. Different antibiotic combinations that have been used successfully in various series include, Ampicillin+ Gentamycin+Metronidazole[7,17] Gentamycin + Metronidazole[18] Gentamycin + Clindamycin[15] Ampicillin + Genta-mycin + Clindamycin[3,4,5,6,14,16,19] Metronidazole + Amikacin,[9] Metronidazole + Cefuroxime[20], Metronidazole + Cefotaxime[8], Cefamandole + Clindamycin[1] and Sulbactam + Ampicillin.[8] Recently, interest has developed in using single agent therapy like Letamoxef[9] ,Cefotetan[21] ,Cefoxitin[9,22,23] and Augmentin[24]. It is apparent from this large number of clinical and laboratory studies, that a comprehensive therapy must include antimicrobials active against both Gram positive organisms and anaerobes as well as aerobes .[7,14,25]

Based on these observations the current management of complicated appendicitis includes pre-operative initiation of empirical antibiotics to cover the expected micro-organisms likely to be cultured. Intra-operative cultures are generally obtained to document the peritoneal bacterial flora and to provide a basis for modification in antibiotic therapy in the post-operative period. However, in actual practice, it is uncommon to make any changes as it is generally assumed that the antibiotic therapy and the sensitivity of organisms will be consistent. Usually the selection and duration of post-operative antibiotic therapy is keyed to the patient's clinical course. The clinical signs of recovery and successful therapy include resolution of fever, leucocytosis resumption of feeding and bowel activity[3,14]. On the other hand, fever, leucocytosis and prolonged ileus are taken as the signs of clinical failure and presence of septic complications like wound and intra abdominal sepsis. In these situations, drainage of pus and not a change in antibiotics is indicated [14].

In the present study, the selection of the antimicrobials was based on their recognized efficacy and the known antibiotic sensitivity pattern of the common bacteria isolated from appendicial peritonitis[7] (Table-2).

The empirical therapy had not to be changed in any patient. Logically, it could be argued that in Group II

all the antibiotics could be stopped and in Group III, there was not justification to continue all the three antibiotics.

Table 2 Sensitivity pattern

Micro-organism	Ampicillin	Gentamycin	Metronidazole
E. Coli	v	s	r
Bacteroides fragilis	v	r	s
Enterococci	s	r	r
Pseudomonas	r	s	r
Klebsiella	r	s	r

v=variable, s=sensitive, r=resistent

Similarly, in both the patient in Group-IV a change in the antibiotic therapy was indicated to conform to the culture results. This fact that was also observed in various other studies[4], indicates a tendency amongst the surgeons to uniformly ignore the culture reports and to use he antibiotics empirically, while monitoring their effects clinically. It may also reflect their increasing confidence in the combination therapy and lack of confidence in the culture and sensitivity reports.

This study and the others[7,14,17] strengthen the view that an empirical antibiotic therapy may be administered confidently with an assumption that it would provide coverage against all the known pathogens of appendicial peritonitis. This study also indicates that as the peritoneal cultures do not change the course of management and are not cost-effective, this practice should be abandoned.

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.**References**

1. Stringel G. Appendicitis in children: A systemic approach for a low incidence of complications. Am J Surg 987; 154: 631-634.
2. Puri, P O'Donnell B. Appendicitis is infancy. J Pediatr Surg 1978; 13: 173-174.
3. King DR, Brownie AF, Burkina GA et al. Antibiotic management of complicated appendicitis. J. Pediatr Surg 1983; 18: 945-950.
4. Samson SL, Rye HMO. Management of perforated appendicitis in children- revisited Arch. Surg 1987; 122: 691-696.
5. Nelson IR., Labege JM, Nguyen LT et al. Appendicitis in children: Current therapeutic recommendations. J Pediatr Surg 1990; 25:1113-1116.
6. David IB, Buck JR, Filler RM. Rational use of antibiotics for perforated appendicitis in children. J Pediatr Surg 1982; 17: 494-500.
7. Mackay AJ Mackellar A, Wild B. The clinical application of bacteriological results of antibiotic prophylaxis for appendicectomy. Pediat Surg Int 1987; 2: 98-100.
8. Foster MC, Morris DL, Legan C, Kapila L, Slack RCB. Perioperative prophylaxis with Sulbactam and Ampicillin compared with Metronidazole and Cephotaxime in the prevention of would infection in children undergoing appendicectomy. J. Pediatr Surg 1987; 22:869-872.
9. Gultierrez C, Vila J, Garcia Sala C et al. Study of appendicitis in children treated with four different antibiotic regimens. J Pediatr Surg 1987; 22: 865-868.
10. Condon RE. Appendicitis. In Sabiston DC (Ed) Textbook of Surgery. Philadelphia, WB Saunders Co 1985, 969-970.
11. Altemier WA. The bacterial flora of acute perforated appendicitis with peritonitis. A bacteriological study based upon one hundred cases. Ann Surg 1938; 107: 517-28.
12. Stone HH. Bacteriological flora of appendicitis in children. J pediatr Surg 1976; 11:37-42.
13. Lari J, Kirk D, Howden R. Bacteriological survey of acute appendicitis in children. Br. J. Surg 1976; 64:643-646.
14. Mosdell DL, Morris DM, Fry DE. Peritoneal cultures and antibiotic therapy in pediatric perforated appendicitis. Am J. Surg 19994; 167: 313-316
15. Bower RJ, Bell MJ, Bell MJ, Ternberg JL. Controversial aspects of appendicitis management in children. Arch Surg 1981; 116: 885-887.
16. Putnam TC, Gagliano N, Emmens RW. Appendicitis in children. Surg Gynaecol Obstet. 1990; 170: 527-532.
17. Burnweit C, Bilik R, Shandling B. Primary closure of contaminated wounds in perforated appendicitis. J Pediatr Surg 1991; 26: 1362-1365.
18. Tsang TM, Tam PKH, Saing H. Delayed Primary wound closure using skin tapes for advance appendicitis in children. Arch Surg 1992;127:451-453.

19. Schwartz MZ, Tapper D, Solenberger RI, Management of perforated appendicitis in children: the controversy continues. Ann Surg 1983: 197: 407-411.
20. Soderquist Elinder C, Hirsch K, Bergdahl S et al. Prophylactic antibiotics in uncomplicated appendicitis during childhood. Eur J Pediatr Surg 1995; 5: 282-285.
21. Huizinga WK, Baker LW, Kadwa H et al. Management of severe intra-abdominal sepsis: single agent antibiotic therapy with cefotetan versus combination therapy with ampicillin, gentamycin, and metronidazole. Br J Surg 1988; 75: 1134-1136.
22. Drasano GL, Warren IW, Saah AJ et al. A prospective randomized controlled trail of cefoxitin versus clindamycin-aminoglycoside in mixed anaerobic infections. Surg Gynaecol Obstet 1982; 154: 715-717.
23. Tally FB, Mc Gowan K, Kelly JM et al. A randomized comparison of cefoxitin with or without Amikacin and clindamycin in surgical sepsis. Ann Surg. 1981; 193: 318-320.
24. Al Dhohyan. Use of augmentin compared to gentamycin and metronidazole in appendicectomy. Eur Surg Res 1994: 13: 177-181.