International Journal of Surgery 8 (2010) 426–429

Contents lists available at ScienceDirect

International Journal of Surgery

journal homepage: www.theijs.com

Review

Peritoneal fluid culture in appendicitis: Review in changing times

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ARTICLE INFO

Article history:
Received 27 December 2009
Accepted 29 June 2010
Available online 15 July 2010

Keywords:
Appendicitis
Appendicectomy
Peritoneal swab
Peritoneal fluid culture

ABSTRACT

Appendicectomy is one of the commoner operations with a lifetime risk as high as 12% or 23% in males or females, respectively. Since the 1940s intra-operative intra-peritoneal swabs have commonly been taken from the appendix site, the spectrum of infecting organisms and their antibiotic sensitivity may be gauged from the culture results. This approach remains common but in recent years, studies have claimed that intra-peritoneal swabs are unnecessary; however, they relied upon retrospective patient groups predating wider use of laparoscopic appendicectomy, increasing numbers of immunocompromised people at risk of appendicitis and the clinical/medicolegal significance of increasing risk of antibiotic-associated *Clostridium difficile* colitis. Therefore, a key-word literature research was done to identify relevant publications from 1930 to June 2009. Newer features relating to intra-peritoneal swabs in appendicectomy have been discussed against this background information for periabdominal appendicectomy with or without appendicular perforation, laparoscopic appendicectomy and appendicectomy in the growing numbers of immunocompromised patients. All studies questioning the use of intra-peritoneal swabs were open, non-randomised, and retrospective with incompletely matched control groups, non-standardised swab collection techniques, and consequently lacked power to inform surgical practice. They concluded that an appropriately powered randomised, blinded, prospective, controlled clinical trial is needed to test for absolute efficacy in the use of peritoneal swabs in patient management. Until controlled trial data becomes available, it may be wise to continue peritoneal swabs at least in high-risk patients to decrease clinical and medicolegal risk.

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1. Introduction

In the developed world, appendicitis is one of the commonest conditions leading to operation in young people;[1] males and females incur a lifetime risk of appendicectomy of 12% and 23.1% respectively.[2] Traditional practice has included an intra-operative, intra-peritoneal swab for culture during appendicectomy. Historically, intra-operative peritoneal swabs became established in the 1940s following Altemeier's paper, which, from all appendectomies studied, isolated 16 aerobic and 18 anaerobic bacterial species.[3] These findings were confirmed and extended by Brook and Lorber[4,5] prompting use of correspondingly 'broad-spectrum' antibiotics in acute and perforated appendicitis.[6–8] In contrast to the blind 'broad-spectrum' approach, intra-peritoneal swabbing was recommended as an aid to the post-operative focusing of antibiotic therapy if the patient became systemically unwell. This practice remains common today with a significant proportion of surgeons routinely taking swabs after removal of the appendix.[9] Use of intra-operative swabs however, appears to be in decline with many surgeons obtaining swabs only when the appendix appears perforated. Perforation may result in free peritonitis, the formation of an abscess or a phlegmon. Antibiotic treatment may be important in medical or surgical management of perforation. Peritoneal lavage may be of debatable efficacy.[10] Surgical drainage is employed in addition to anti-microbial therapy in those unlucky enough to suffer a large abscess (>1–2 cm).[11] Medical therapy with antibiotics is important both prophylactically and as indicated in a septic patient or one with evidence of perforation; it is in the latter two instances where results of peritoneal swab culture can crucially guide antibiotic choice. This traditional assumption has been challenged with several retrospective studies; all concluded that peritoneal swabs were an unnecessary use of resources that do not contribute to significant improvement in patient care.[12–15] In spite of these negative studies a more recent publication found that 35.3% of children undergoing appendicectomy had peritoneal swabs taken.[9] Philosophically it is difficult to 'prove a negative' and retrospective studies are prone to statistical error. No study so far

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doi:10.1016/j.ijsu.2010.06.016

has used a prospective, randomised, blinded, placebo-controlled approach crucial to demonstrate absolute treatment efficacy or in a sufficiently powered study, its absence!

2. Materials and methods

A literature search (NIH database, Medline, Pubmed) used the key words: appendicectomy, peritoneal swab/culture, intra-operative culture, microbiological findings in abdominal operations. Further manual cross-referencing was then performed on other relevant publications. Literature search only included articles published in English from 1930 to June 2009.

3. Results

Despite the clinical significance of the subject, the authors found few articles that could be of value to the up-to-date modern day surgeons.

3.1. Peritoneal swabs in appendicitis without perforation

A retrospective study of 3029 appendicectomies, with 2500 positive histological diagnoses of appendicitis showed the majority (84%) were non-perforated.[16] Patients who undergo appendicectomy where a non-perforated, inflamed appendix is found are at far less risk of intra-abdominal sepsis. In these cases it may be justified to omit performing a peritoneal culture as recommended by some authors.[9,17]

Patients undergoing operations where the procedure is difficult or the surgeon is a trainee, may benefit from peritoneal swabs. The surgical procedure may, in these cases be responsible per se for the contamination of the peritoneal space leading to intra-abdominal sepsis. In the majority of these cases the contaminating flora will be predictable[3–5] and will likely be susceptible to broad spectrum antibiotics. An increasing number of patients are now vulnerable to rarer infections; this group consists of the immunocompromised (please see below) and those receiving multiple courses of antibiotic therapy encouraging microbial resistance[18]; more caution must be taken in these patients, with the use of peritoneal swabs being at the discretion of the senior surgeon.

3.2. Peritoneal swabs in appendicitis with perforation

Commonly broad spectrum antibiotics are prescribed prophylactically, peri-operatively in acute appendicitis and post-operatively when an appendix has perforated. Initial studies rendered predictable the flora that may contaminate the peritoneal space and availability of correspondingly broad spectrum antimicrobials to cover these organisms could preclude the need for cultures.[17,19] Studies supporting this negative view have been retrospective and lacked the power to discriminate between use or omission of swabs; some even failed to obtain cultures from all patients e.g., swabs were obtained in only 721 of 808 people in one study.[19] Furthermore, these studies ignored the advantage of 'narrower' spectrum antimicrobials that may pose less risk of Clostridium difficile colitis now becoming a hazard even in younger patients.

Several arguments prompt the continuing practice of peritoneal swabbing. In the absence of data from peritoneal culture, trends or changes in infectivity could be missed precluding a future predictive guide to empirical anti-microbial therapy. Microbial variations can be seasonal[20] showing higher rates of gram negative infection during the warmer summer months (similarly for seasonal variation in enteric infections).[21] The spectrum of microbial infection also differs geographically along with anti-bacterial resistance patterns[22] suggesting that local cultures are useful in allowing for these variations. Moawad et al. suggested the use of peritoneal culture in allowing epidemiological tracking of those organisms that are responsible for serious disease yet are more rarely isolated. In complex individual patients peritoneal swabs could provide useful and reassuring evidence of microbial antibiotic sensitivities.[17]

3.3. Peritoneal swabs in the immunocompromised patient

In contemporary surgical practice, the incidence of infectious diseases not previously encountered in the northern hemisphere is substantially greater because of widespread travel and immigration. Combined with the rising prevalence of HIV[23] and the immunosupression resulting from powerful immune modulating drugs in chronic disease management, these circumstances have led to increasing risk of rarer and more difficult to treat infections. HIV, treated with highly active antiretroviral is now a chronic condition with an increasing prevalence in the younger age groups more susceptible to appendicitis. Perhaps, even under these changed circumstances, there is truly a place for peritoneal swab cultures. This traditional approach would then safeguard appropriate antibiotic therapy in patients whose immunocompromised states may result in sepsis from organisms other than those infecting bacteria regarded as common or predictable, thus a more guided approach to anti-microbial use is possible in those who fail to respond to currently accepted empirical therapy.

The immuno-suppressed are at greater risk of infection from less predictably virulent organisms, many of which may be part of the normal flora.[24] Numbers of immune compromised patients are increasing, from both disease (e.g. the increasing prevalence of HIV infection) and immunosuppressive treatment of disease, for example, those undergoing chemotherapy for cancer or the increasing numbers of patients undergoing organ transplantation. Sepsis from a perforated appendix in these patients will be far harder to treat and if there is no response to empirical therapy then without peritoneal swab results there will be little to guide (except possibly blood cultures) the surgeon's choice of anti-microbial agent/s. In individuals among these ever-increasing numbers of patients, unlike non-immunocompromised people, there is no evidence to predict likely infecting organisms and their antibiotic sensitivities following appendicular perforation. Therefore, it could be difficult to justify omission of peritoneal swabs until relevant, carefully controlled, prospective research has been done. Correspondingly, Kokoska et al. noted the value of culture in neutropaenic or immunosupressed patients.[12]

3.4. Peritoneal swabs in laparoscopic appendicectomy

Length of hospital stay of patients with appendicitis has decreased in parallel with improved surgical management from approximately 2 days post laparoscopic appendicectomy to 4.8 ± 2 days if the appendix was perforated.[25] Against this backdrop of shorter in patient stays the median times of 1 day to receive and 3 days for reporting of culture results are potentially too slow to influence management with alteration of antimicrobials only if the patient becomes unwell and is readmitted (17). Culture results rarely feature in clinical decision pathways, these may be ignored or could conceivably worsen patient outcome since intra-operative cultures only approximate the spectrum of organisms likely present and may adversely narrow the spectrum of chosen antibiotics.[8,12,13,26] On top of that, the extra cost of performing the culture may be deemed unnecessary in completion patients' management, aerobic and anaerobic culture may cost about 30 dollars per swab.[12]

The technique of collection of peritoneal swabs was not discussed in any papers identified by the authors' search; the swab is taken in the open appendicectomy quite simply from the directly visualised appendiceal stump, although swab collection is

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