Compliance with an empirical antimicrobial protocol improves the outcome of complicated intra-abdominal infections: a prospective observational study

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Abstract

Background: Despite improvements in medical and surgical care, mortality attributed to complicated intra-abdominal infections (cIAI) remains high. Appropriate initial antimicrobial therapy (ABT) is key to successful management. The main causes of non-compliance with empirical protocols have not been clearly described.

Methods: An empirical ABT protocol was designed according to guidelines, validated in the institution and widely disseminated. All patients with cIAI (2009–2011) were then prospectively studied to evaluate compliance with this protocol and its impact on outcome. Patients were classified into two groups according to whether or not they received ABT in compliance with the protocol.

Results: 310 patients were included: 223 (71.9%) with community-acquired and 87 (28.1%) with healthcare-associated cIAI [mean age 60(17–97) yr, mean SAPS II score 24(16)]. Empirical ABT complied with the protocol in 52.3% of patients. The appropriateness of empirical ABT to target the bacteria isolated was 80%. Independent factors associated with non-compliance with the protocol were the anaesthetist's age ≥36 yr [OR 2.1; 95%CI (1.3–3.4)] and the presence of risk factors for multidrug-resistant bacteria (MDRB) [OR 5.4; 95%CI (3.0–9.5)]. Non-compliance with the protocol was associated with higher mortality (14.9 *vs* 5.6%, *P*=0.011) and morbidity: relaparotomy (*P*=0.047), haemodynamic failure (*P*=0.001), postoperative pneumonia (*P*=0.025), longer duration of mechanical ventilation (*P*<0.001), longer ICU stay (*P*<0.001) and longer hospital stay (*P*=0.002). On multivariate logistic regression analysis, non-compliance with the ABT protocol was independently associated with mortality [OR 2.4; 95% CI (1.1–5.7), *P*=0.04].

Conclusions: Non-compliance with empirical ABT guidelines in cIAI is associated with increased morbidity and mortality. Information campaigns should target older anaesthetists and risk factors for MDRB.

Key words: antimicrobial agent; outcome; protocol compliance; secondary peritonitis

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Editor's key points

- This study evaluated the whether compliance with an antimicrobial protocol affected outcome in patients with intra-abdominal infections.
- Non-compliance with the protocol was associated with worse clinical outcomes in a single centre.
- Anaesthetist's age and several clinical factors were associated with non-compliance.
- More work is needed to determine how compliance can be improved.

Despite improvements in surgical and medical care, particularly progress in antibiotic therapy, the mortality attributed to secondary peritonitis remains high, between 4 and 30%, depending on the severity and the site of infection.[1–4] These infections represent the second leading septic cause of ICU admission after respiratory tract infections,[5] and the third leading cause of septic shock.[6] Secondary peritonitis comprises a broad range of pathological conditions, including community-acquired peritonitis and nosocomial peritonitis (including postoperative peritonitis). The keys to successful management are early diagnosis, appropriate surgical intervention, and administration of systemic antibiotics that are effective against both aerobic and anaerobic bacteria.[7] Surgical treatment usually consists of laparotomy to eliminate the source of infection, intraoperative peritoneal lavage to reduce the bacterial load, and drainage for prevention of persistent or recurrent infection.[8] Seiler and colleagues[9]. reported an increase of mortality rates from 13 to 27% depending on the adequacy of surgery, with reoperation rates ranging from 9 to 32%. Early empirical antibiotic therapy is a well-established recommendation.[7] Kumar and colleagues[6] reported that the survival rate decreased by 7.6% per h when antibiotic therapy was delayed in patients with septic shock. Most studies of intra-abdominal infections have shown that appropriate empirical antibiotic therapy improved the clinical success rate and reduced the length of hospital stay and overall costs.[10 11] However, when empirical antibiotic therapy is inappropriate, patients may require reoperation, resulting in a poorer outcome[12–17] and an increased likelihood of multidrug-resistant bacteria (MDRB) such as *Pseudomonas aeruginosa* and yeasts.[14 18]

Education and stewardship of rational antibiotic use in France, have become a major public health challenge for the World Health Organization (WHO) and the European Community over recent yr. Most published studies have evaluated clinical practice in relation to implementation of antibiotic prescription protocols, and have demonstrated an improvement antibiotic prescription practices.[19] After a local evaluation of prescription practices in community-acquired peritonitis demonstrated a high rate of inappropriate empirical antimicrobial therapy, an antibiotic protocol was established for use in emergency operating rooms with a planned follow-up assessment. The aim of the present study was to assess the main causes of non-compliance with the antimicrobial protocol for complicated intra-abdominal infections (cIAI) and to assess its relationship with outcome.

Methods

Study design and patients

A single-centre, prospective study was conducted in all patients with complicated intra-abdominal infections (cIAI) treated at our institution between January 2009 and December 2011. This study was approved by the local ethics committee. According to French law, informed consent was waived because of the observational, non-interventional nature of the study.

Patients under the age of 18 yr, with primary peritonitis (medical causes of intra-abdominal infection not requiring surgical therapy such as infected ascites), infected acute pancreatitis, postoperative nosocomial infection, and acute traumatic perforation <6 h were not included in the study.

All patients in the period were consecutively included according to the registry of the emergency operating room.

Surgery and microbiological management

Surgery was performed by an experienced team according to the same guidelines for the management of cIAI. Laparoscopy or laparotomy was performed depending on the diagnosis and as decided by the surgeon responsible. All peritoneal fluid samples were systematically sent to the microbiology and mycology departments. Antimicrobial therapy was initiated as soon as possible according to our empirical protocol. At least one set of blood cultures were obtained preoperatively. Culture and antibiotic susceptibility testing were performed in the microbiology department.

Definitions and protocol

The empirical antimicrobial therapy protocol (Table 1) was established in agreement with the hospital's infection control committee and was then displayed in operating rooms. All surgeons and anaesthetists involved in the emergency operating room (OR) were informed about this protocol by e-mail and at meetings and the protocol was posted in the OR.

A complicated intra-abdominal infection was defined as a complicated intra-abdominal infection extending beyond the hollow viscus of origin into the peritoneal space and associated

Table 1 Empirical antimicrobial protocol in community-acquired and healthcare-associated complicated intra-abdominal infections. MDRB, multidrug resistant bacteria

Risk factor for MDRB	Beta-lactam allergy	Illness severity	
		No	**Yes**
No	No	Cefotaxime or Ceftriaxone+metronidazole OR Amoxicillin/clavulanate+gentamicin	Piperacillin/tazobactam+gentamicin
	Yes	Levofloxacin+metronidazole	Levofloxacin+metronidazole+gentamicin
Yes	No	Ertapenem	Imipenem+vancomycin+amikacin
	Yes	Tigecycline	Tigecycline+ciprofloxacin