Computed Tomography-guided Percutaneous Drainage in the Management of Intraperitoneal Abscess

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We carried out a retrospective analysis of 84 patients with intraperitoneal abscesses treated at Kaohsiung Medical University Hospital, Taiwan to assess our experience in their management. We compared outcomes between surgical drainage and computed tomography (CT)-guided percutaneous drainage. Each patient’s characteristics, origin of abscess, clinical presentation, microbiology, Acute Physiology and Chronic Health Evaluation (APACHE) II score, treatment, and clinical outcomes were recorded. We compared patients’ age, sex, complications, hospitalization days, morbidity, and mortality rate between those receiving surgical treatment and those receiving CT-guided percutaneous drainage. The most frequent symptoms and signs of these patients were leukocytosis, followed by fever and abdominal pain. There were significant differences in wound infection (p = 0.007), recurrent rate (p = 0.009), and enterocutaneous fistula (p = 0.032) between the two groups. In both groups, a higher APACHE II score was associated with both a higher morbidity and mortality (p < 0.001). Despite the higher recurrent rate, CT-guided percutaneous drainage was a safe and effective therapeutic alternative procedure to surgery when used as a definitive treatment. Surgical treatment is suggested in selected patients with either a complicated intraperitoneal abscess or failed CT-guided drainage.

Key Words: APACHE II score; CT-guided drainage; intraperitoneal abscess; surgical treatment

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Introduction

Abdominal infection is defined as the presence of pus or gastrointestinal content in the abdominal cavity. Based on the degree to which host defenses have localized the infection, it may take the form of a diffuse process in the peritoneal cavity (peritonitis) or a local collection of pus (abscess).1 Intra-abdominal abscesses have typically been classified by their anatomic location: intraperitoneal, retroperitoneal, or visceral. The mortality in un-drained abdominal abscesses is high with a mortality rate ranging between 45–100%.2,3 Intrapерitoneal abscesses usually begin as areas of localized peritonitis where infection has been walled off by the omentum, adjacent organs, and/or the peritoneum. Retroperitoneal abscesses include pancreatitis-associated infections, perinephric abscesses, and paravertebral abscesses. Visceral abscesses develop within abdominal viscera, predominantly the liver, and less often in the spleen and other organs.

There is little information available on intraperitoneal abscesses. Therefore, the aim of this retrospective study was to describe our experience in their treatment. We compared the clinical outcomes of patients with intraperitoneal abscesses between two groups, surgical vs. computed tomography (CT) – guided percutaneous drainage. Furthermore, the relationship between the Acute Physiology and Chronic Health Evaluation (APACHE) II score and patients’ morbidity/mortality was analyzed.

Materials and Methods

Patients and methods

The records of 84 patients with intraperitoneal abscesses admitted to Kaohsiung Medical University Hospital in the past 5 years were retrospectively reviewed. All patients had a diagnosis of intraperitoneal abscess confirmed by CT scans or ultrasonography prior to a therapeutic procedure. In addition, all patients were evaluated using the APACHE II scoring system.4 Timing of this assessment was within 24 hours prior to therapeutic intervention in all cases.

Percutaneous drainage of abscesses was attempted if the following conditions were met according to Aeder et al.:5 (1) no more than two abscess cavities or loculations were present; (2) the drainage route did not transverse the bowel or any uncontaminated organs; (3) the viscosity of the abscess material allowed for complete aspiration at the initial procedure; and (4) the cause of abscess was not definite by radiologists. However, some patients received CT-guided drainage in spite of being poor candidates, because they refused surgical treatment. Surgical intervention is preferred in those patients who are suited or advised after consultation by radiologists and surgeons. The approach to surgical treatment of an abscess was determined by the location of the abscess, the presumed underlying disease, the patient’s clinical condition, and the surgeon’s preference. Forty-nine patients underwent surgical treatment and 35 received CT-guided drainage as a primary procedure. All intraoperatively placed drains were removed when the patient was afebrile, there was no leukocytosis by complete blood count, and no abdominal pain was noted. The records were examined for sex, age, underlying disease, clinical presentations, cause of the abscess, microbiologic data, therapy including the type of drainage and operation, complications, and outcome. Mortality was defined as the patient’s death within 30 days of this treatment.

Statistical analysis

All continuous data are expressed as mean± standard error. Statistical analyses were performed using SPSS version 8.0 (SPSS Inc., Chicago, IL, USA). All nominal data were tested with Fischer’s exact test or \( \chi^2 \) test between the surgical group and CT-guided drainage group. The significance of the correlation between APACHE II score and morbidity and mortality among the groups was evaluated by analysis of variance. A probability of less than 0.05 was considered to be statistically significant.

Results

Of the 84 patients included in the study, 46 (54.8%) were men and 38 (45.2%) were women. Their age ranged from 14 to 91 years, with an average of 45.9 years. The demography of 84 patients is listed in Table 1. Frequent premorbid conditions were hypertension (13.1%), diabetes (11.9%), malignancy (11.9%), and anemia (11.9%). Some patients had more than one pre-morbid condition but 36 patients did not have any underlying disease. The most frequent symptoms and signs were leukocytosis, followed by fever, and abdominal pain (Table 2). The culturing abscess materials obtained by the surgical method or percutaneous catheter were available for 70 patients (83.3%). Cultures were made for aerobes, anaerobes, mycobacteria, and fungi examination. Of these 70 cultures, 5 cultures (7.1%) were sterile. The most commonly isolated pathogen in aerobic and anaerobic bacteria was Escherichia coli and Bacteroides (Table 3). However, polymicrobial abscesses were found in 22 of the 70 cultures (26.2%), of which E. coli plus Bacteroides were seen in 15 of the 22 cultures (68.2%). The most frequent origin
of intraperitoneal abscesses resulted from post-operation, followed by appendicitis rupture and diverticulitis with rupture (Table 4). The origin of intraperitoneal abscess could not be identified in two patients.

We compared the results following surgical treatment and CT-guided drainage in the management of 84 cases with intraperitoneal abscess (Table 5). We found that patients who underwent surgical treatment had a significantly higher amount of wound infections ($p=0.007$) and enterocutaneous fistula than the group with percutaneous drainage ($p=0.032$), whereas the recurrent rate was considerably higher in the group with percutaneous drainage compared with surgical treatment ($p=0.009$). There was no difference in mortality between the two groups ($p=0.371$). Patients who developed complications had a higher APACHE II score than those who did not, and those patients who died had significantly higher APACHE II scores than survivors ($p<0.001$; Figure 1).

**Discussion**

There are many potential etiologies for intra-abdominal abscesses. They may occur after an abdominal operation or penetrating abdominal injury, or be secondary to intra-abdominal conditions such as...
as diverticulitis, appendicitis, biliary tract disease, pancreatitis, a perforated viscus, or peritonitis. The mortality in un-drained abdominal abscesses is high with a mortality rate ranging between 45−100%.2,3

An intraperitoneal abscess is the major type of intra-abdominal abscess; thus this study retrospectively reviewed our experiences of 84 cases with intraperitoneal abscesses.

Cross-sectional imaging techniques such as ultrasound images and CT scanning have become the most common techniques for diagnosing intra-abdominal abscesses.6 With the advent of ultrasonography and abdominal computed tomography, it is possible to identify and accurately determine the location of an intra-abdominal abscess prior to operation.7,8 Conversely, ultrasound images can be obscured by bowel gas, which is frequently present due to the associated ileus that often occurs with an abscess. CT examinations are most helpful when the clinical suspicion of intra-abdominal abscess is high, based either on a history or clinical findings or both. Its specificity and sensitivity rate can exceed 90%. Johnson et al9 recommended an early evaluation with CT of patients with suspected abdominal abscess. Civardi et al10 suggested that CT scans are very useful for appropriate topographic evaluation and as an alternative guidance technique when ultrasonography is not possible. Although the location of the abscess may determine its presenting symptoms or signs, abdominal pain, fever, and leukocytosis are most commonly encountered. In our series of intra-peritoneal abscesses, there were similar clinical presentations, of which the most common presenting symptom/sign was leukocytosis (Table 2).

A key attribute in the treatment of all intra-abdominal abscesses is the primary role of source control in the treatment algorithm.11 The traditional therapy of intra-abdominal abscess is operative drainage. According to the criteria for CT-assisted percutaneous drainage by Aeder et al5 we performed two therapeutic modalities for intraperitoneal abscesses (surgical vs. CT-guided drainage). However, the most important consideration in choosing a drainage technique, independent of the technique itself, is the severity of illness of the patient with an intraperitoneal abscess. When an abscess is identified and safe access for drainage is available, percutaneous catheter drainage under CT or ultrasound guidance is recommended as the initial mode of therapy.5,9,12,13

During the past 15 years, many studies have been conducted to compare the results of percutaneous drainage with the results of surgical drainage in patients with intra-abdominal abscesses. Their findings

| Table 5 Comparison of results following surgical treatment and computed tomography (CT)–guided drainage in the management of 84 cases with intraperitoneal abscesses |
|-------------------------------------------------|-------------------------------------------------|-----------------|
| Surgical method (n=49)                          | CT-guided drainage (n=35)                        | p               |
| Age (yr)                                        | 48.9±2.6                                        | 41.7±3.2        | 0.083 |
| Sex (M/F)                                       | 26/23                                           | 20/15           | 0.711 |
| Complications                                   | 21 (42.8%)                                      | 17 (48.5%)      | 0.604 |
| Wound infection                                 | 12 (24.5%)                                      | 1 (2.6%)        | 0.007* |
| Abdominal wall abscess                          | 0 (0%)                                          | 2 (5.7%)        | 0.171 |
| Inadvertent puncture                            | 0 (0%)                                          | 2 (5.7%)        | 0.171 |
| Bleeding                                        | 0 (0%)                                          | 2 (5.7%)        | 0.171 |
| Recurrent rate                                  | 2 (4.1%)                                        | 8 (22.9%)       | 0.009* |
| Enterocutaneous fistula                         | 6 (12.2%)                                       | 0 (0%)          | 0.032* |
| Ileus                                           | 9 (18.4%)                                       | 2 (5.7%)        | 0.09  |
| Pneumonia                                       | 2 (4.1%)                                        | 0 (0%)          | 0.508 |
| Mortality                                       | 1 (2.0%)                                        | 2 (5.7%)        | 0.371 |
| Hospitalization (d)                             | 21.2±2.1                                        | 18.8±3.1        | 0.507 |

*p<0.05. M: male; F: female.

Figure 1 Association between the APACHE II score and cure, complications and death. A higher APACHE II score was associated with both higher morbidity and higher mortality (p<0.001).
suggest that percutaneous drainage of an abscess can be performed as safely as surgical drainage.\(^6,14\)

Our current study is the first to focus on intraperitoneal abscesses with a review of the literature. Recent studies have indicated that an objective severity-of-illness scoring system is prognostic in terms of morbidity and mortality.\(^{14,15}\) A widely used system for the evaluation of severity of illness is the APACHE II score, which was developed by Knaus et al.\(^4\) Similar to Hemming et al.,\(^{14}\) our observations show that the APACHE II score was significantly associated with the patients’ prognosis. The APACHE II score is prognostic of both potential mortality and morbidity in patients with intraperitoneal abscesses. In our series of intraperitoneal abscesses, we showed that there were significant differences in wound infection, recurrence, and enterocutaneous fistula which was proved by fistulography or clinical signs of enteric discharge between the two groups. The recurrence rate of the CT-guided drainage group was significantly higher than that in the surgical group. A possible reason for this finding may be that the patients were poor candidates for percutaneous drainage but they insisted on receiving this procedure.

In summary, we carried out a nonrandomized and retrospective study and analyzed the treatment results and complications between the two different managements for patients with intraperitoneal abscesses. Since the selection of management was not randomized, the results can only provide information for treatment of intraperitoneal abscesses and not indicate which treatment is better. We conclude that CT-guided drainage is a safe and effective management for intraperitoneal abscesses. However, the surgical method is an alternative to CT-guided drainage and it reduces the recurrent rate in patients who were not suited with the percutaneous drainage procedure after evaluation.

**References**