Optimal Treatment of Hepatic Abscess

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Many treatment strategies have been proposed for pyogenic liver abscesses; however, the indications for liver resection for treatment have not been studied in a systematic manner. The purpose of our study was to evaluate the role of surgical treatment in pyogenic abscesses and to determine an optimal treatment algorithm. We retrospectively reviewed the medical records of all patients who had a pyogenic liver abscess at Rhode Island Hospital between 1995 and 2002. Abscesses and treatment strategies were classified into three groups each. The abscess groups included Abscess Type I (small <3 cm), Abscess Type II (large >3 cm, unilocular), and Abscess Type III (large >3 cm, complex multilocular). The treatment strategy groups included Treatment Group A (antibiotics alone), Treatment Group B (percutaneous drainage plus antibiotics), and Treatment Group C (primary surgical therapy). Descriptive statistics were calculated and χ^2 used for comparison with a $P < 0.05$ considered significant. Our study consisted of 107 patients with pyogenic liver abscess. The success rate for small abscesses treated with antibiotics was 100 per cent. The success rate with antibiotics and percutaneous drainage for large, unilocular abscesses was 83 per cent and for large, multiloculated abscesses was 33 per cent. None of the 27 patients who had surgical therapy for large, multiloculated abscesses had recurrences. Surgical treatment for large (>3 cm), multiloculated abscesses had a significantly higher success rate than percutaneous drainage plus antibiotic therapy (33% *versus* 100%, $P \leq 0.01$). The mortality rate for the percutaneous drainage plus antibiotic group was not significantly different from the primary surgical group (4.2% *versus* 7.4%, $P = 0.40$). We propose a treatment algorithm with small abscesses being treated with antibiotics alone; large, uniloculated abscess with percutaneous drainage plus antibiotics; and large, multiloculated abscessed treated with surgical therapy.

PYOGENIC LIVER ABSCESSES, although rare, are a formidable challenge to surgeons and are historically associated with a high morbidity and mortality rate.[1–3] Although there appears to be an increasing incidence of pyogenic liver abscesses, the mortality rate has been reported to be decreasing, most likely as a result of advances in imaging modalities and earlier detection.[4] Until the early 1980s, pyogenic liver abscesses were treated primarily by surgical methods; however, with improvements in imaging modalities, development of new broad-spectrum antibiotics, and the advent of percutaneous drainage, the majority of these abscesses are now treated nonsurgically with good outcomes reported.[5, 6]

Although percutaneous drainage and antibiotics remain the current standard for the treatment of small liver abscesses, debate continues regarding the optimal treatment for large or multiloculated abscesses. Large abscesses are often multiloculated and can contain thick, viscid pus, which may make percutaneous drainage difficult. Recently, surgical drainage was reported to have better outcomes than percutaneous drainage in abscesses greater than 5 cm[7]; however, this subject is debated.[8]

Another treatment strategy that has not been well studied for large pyogenic liver abscesses is surgical treatment with liver resection. Initially this treatment option seems overly aggressive for a diagnosis that may be treated using less invasive options; however, with improvements in surgical technique, anatomy, and anesthetic care, liver resections have been shown to have an acceptable morbidity and mortality rate.[9] There has also been no uniform classification for pyogenic liver abscesses or treatment strategies. The purpose of this project was to classify pyogenic liver abscess and treatment strategies, to document outcomes, and to propose an algorithm for treatment.

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FIG. 1. CT scan of a Type I liver abscess (<3 cm).

Methods

After obtaining Institutional Review Board approval, we retrospectively reviewed the medical records of all patients who had a pyogenic liver abscess at the Rhode Island Hospital between 1995 and 2002. The data obtained included abscess characteristics and sizes, treatment strategies, failure rates, and mortalities. Failure of treatment was defined as an abscess recurrence, which included return of clinical symptoms with fever, pain, or elevated white blood cell count, or recurrence of the abscess(es) as seen on ultrasound or CT. Abscesses were classified according to three types and treatment classified according to three strategies. Abscess types included Type I (small <3 cm), Type II (large >3 cm, unilocular), and Type III (large >3 cm, complex multilocular) and are shown in Figures 1 through 3. The treatment groups included Group I (antibiotic treatment alone), Group II (percutaneous drainage plus antibiotics), and Group III (primary surgical therapy/resection). Data were compiled and analyzed using StatView for Power Macintosh (version 4.5; Berkeley, CA). All continuous data are expressed as mean ± standard deviation. Unpaired Student *t* test or analysis of variance was used to compare continuous variables as appropriate. Discrete variables were compared with χ^2 test corrected with Fisher's post hoc. A *P* value of less than 0.05 was considered statistically significant.

FIG. 2. CT scan of a Type II liver abscess (>3 cm, simple, unilocular).

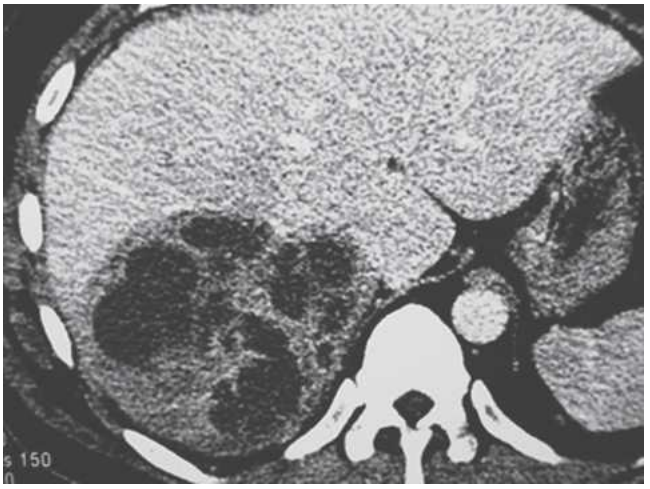

FIG. 3. CT scan of a Type III liver abscess (>3 cm, complex, multilocular).

Results

Our study consisted of 107 patients with pyogenic liver abscesses. Eight patients (7%) had a small (<3 cm) pyogenic liver abscess (Type I), 48 patients (48%) had a large (>3 cm), uniloculated abscess (Type II), and 51 patients (45%) had large (>3 cm), multiloculated abscesses (Type III). Treatment strategies and success rates based on type of pyogenic liver abscesses are listed in Table 1.

The treatment for Type I abscesses included antibiotic therapy in all eight patients (Treatment Group A) with a 100 per cent success rate and no mortalities. Treatment for Type II abscesses included percutaneous drainage and antibiotics in all 48 patients (Treatment Group B). This treatment strategy was successful in 40 of the 48 patients for an overall success rate of 83 per cent. The eight patients who failed initial percutaneous drainage were successfully treated with a second percutaneous drainage procedure (100%).

TABLE 1. *Treatment Strategies and Success Rates Based on Type of Pyogenic Abscess*

	Treatment Group A (antibiotics only)	Treatment Group B (percutaneous drainage plus antibiotics)	Treatment Group C (primary surgical treatment)	*P* Value
Abscess Type I (small abscess <3 cm)	8/8 patients (100%)			N/A
Abscess Type II (large abscess >3 cm, uniloculated)		40/48 patients (83%)		N/A
Abscess Type III (large abscess >3 cm, multiloculated)		8/24 patients (33%)	27/27 patients (100%)	<0.0001

Treatment for Type III abscesses included percutaneous drainage and antibiotics for 24 patients (Treatment Group B) and primary surgical therapy for 27 patients (Treatment Group C). Successful treatment outcomes for Type III abscesses with percutaneous drainage and antibiotics (Group B) occurred in eight of the 24 patients (33%). Of the 16 recurrences, eight patients were successfully treated with repeat percutaneous drainage (50%), three patients died (19%), and five patients were successfully treated with surgical resection (31%). Successful treatment outcomes for Type III abscesses with surgical therapy occurred in all 27 of the patients (100%). The findings at surgery typically included fibrotic loculated collections of purulence (Fig. 4).

Surgical therapy had a significantly higher success rate for Type III abscesses compared with percutaneous drainage plus antibiotics (100% *versus* 33%, $P < 0.0001$). There were no mortalities for the group treated with antibiotics only (Group A). The overall mortality rate was 4.7 per cent. All three deaths in the percutaneous drainage plus antibiotic group occurred in large (>3 cm), multiloculated abscesses (Type III). The mortality rate for the percutaneous drainage plus antibiotic group (Group B) was not significantly different from the primary surgical group (4.2% *versus* 7.4%, $P = 0.40$).

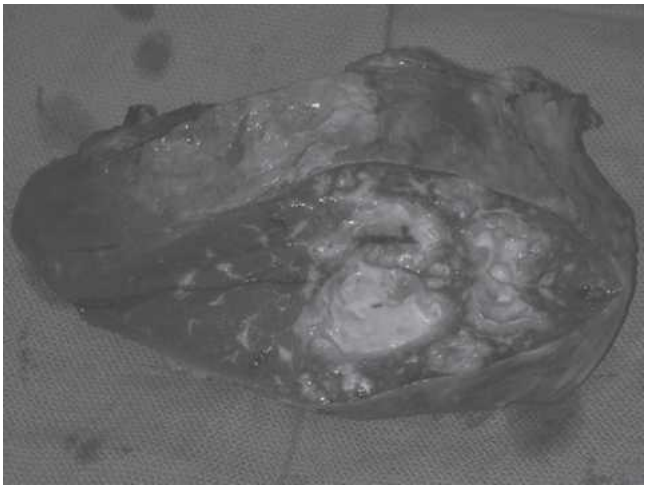

FIG. 4. Resected pyogenic liver abscess.

Discussion

Pyogenic liver abscesses are a rare but life-threatening disease with reported incidences ranging from 446 per 100,000 hospital admissions[10] from a study in Taiwan to 12 per 1,000,000 for men and 10 per 1,000,000 for women[4] from a population study from Denmark. Although appendicitis was traditionally the most common cause of pyogenic liver abscesses, biliary tract disease accounts for the majority of abscesses currently. Although not documented in all cases, etiology of abscesses in this study followed the current trends with the majority being secondary to biliary tract disease with hematological spread and spread from intra-abdominal sources making up the remainder. Polymicrobial infections are typical with pyogenic liver abscesses with *Escherichia coli* and *Klebsiella pneumonia* being the two most commonly isolated pathogens. Antibiotic regimens covering the suspected pathogens such as beta-lactam/beta-lactamase inhibitor combinations, second-generation cephalosporins with anaerobic coverage, or carbapenems are typically the recommended antibiotic coverage until cultures are returned. Documented bacteriology was not available for all abscesses in this study; however, antibiotic treatment typically followed the recommended empiric treatments aimed at the common pathogens until final cultures were returned.

As a result of the rarity of this disease process, the literature regarding this topic mainly consists of case reports, small case series, and only a few large retrospective or case-controlled studies. As a result of the lack of sizable studies and lack of a true classification scheme for these abscesses, confusion continues regarding the optimal treatment strategies based on size and characteristics of these abscesses.

Historically, surgical therapy by open drainage was the mainstay of treatment; however, with the advent of improved imaging techniques, image-guided drainage applications, and improved antibiotics, treatment has now shifted to encompass these less invasive methods. Percutaneous drainage of pyogenic abscesses is an attractive option as a result of its minimally invasive approach and the ability to perform the procedure without general anesthesia. Encouraging results of

percutaneous drainage, with success rates ranging from 76 per cent to over 90 per cent,[8, 11] have led many authors to recommend it as the treatment of choice for pyogenic abscesses of the liver.[12, 13] Although the majority of pyogenic liver abscesses can and should be treated with percutaneous drainage, not all of these abscesses are amenable to this therapy or should be subjected to this as a result of the higher failure rates reported for certain abscess characteristics.

Although single, small pyogenic abscesses are generally adequately treated by percutaneous drainage, debate continues on the optimal treatment of large and multiple or multiloculated abscesses. Although there are reports of successful treatment of pyogenic abscesses by percutaneous drainage,[8, 14] several reports have shown this treatment to be unsuitable[15, 16] or have shown less favorable outcomes compared with treatment of single abscesses.[17] Reduced effectiveness of percutaneous drainage for multiloculated abscesses resulting from compartmentalization has also been reported by Farges and colleagues[18] and Barakate and colleagues.[19] Aside from characteristics of the pyogenic abscess (such as unilocular or multilocular and single or multiple), size is an important factor in determining outcomes from treatment. Recently, Tan and colleagues[7] evaluated treatment strategies for large (>5 cm) pyogenic abscesses. They reported that, for large abscesses, surgical drainage provides better clinical outcomes than percutaneous drainage in terms of treatment success, number of secondary procedures, and hospital stay with comparable morbidity and mortality rates and recommended surgical drainage as a first-line treatment for large liver abscesses.[7] Interestingly, 80 per cent of the abscesses treated were also multiloculated, meaning that these were not only large but also complex abscesses.[7] Other reported indications for surgical therapy of pyogenic abscesses include rupture, difficult access secondary to anatomic location, coexisting pathology requiring open surgery, and incomplete percutaneous drainage.[18, 19]

A unique characteristic of our study is that surgical therapy was not simple open surgical drainage, but rather a partial or anatomic liver resection. Although this may seem a drastic measure for the treatment of a pyogenic liver abscess, it resulted in success in all patients undergoing resection with statistically similar mortality rates compared with patients with similar types of abscesses who underwent percutaneous drainage plus antibiotic therapy. Our mortality rates are comparable although higher than the 4.5 per cent rate for surgical drainage and 2.8 per cent rate for percutaneous drainage reported by Tan and colleagues.[7] Although surgical resection has been previously reported in a case report for treatment of a multiloculated pyogenic liver abscess,[16] our study is the largest series evaluating this treatment. One drawback of our study, however, is we do not compare surgical resection with surgical drainage for the treatment of large, complex multilocular abscesses. Open surgical drainage for large, multiloculated abscesses has been shown to be safe and efficacious and recently reported to have improved clinical outcomes compared with percutaneous drainage.[7] Although rare, large, multiloculated abscesses can span anatomic partitions between the right and left lobes of the liver making resection undesirable; these may be better served with open surgical drainage.

We aimed to organize treatment strategies based on abscess characteristics so that we could propose an algorithm for treatment. Although our study has the limitations of all retrospective reviews, namely selection bias and small sample sizes, we believe that the information gained from our results and the algorithm proposed will be beneficial for the treatment of these rare but serious pyogenic abscesses. Our proposed treatment algorithm is shown in Figure 5. Although our algorithm is based on small patient numbers in some instances such as with antibiotic therapy alone for small (<3 cm) abscesses, this is a starting point for the potential use of this algorithm for further study and a standardized classification scheme and treatment algorithm for reporting on this subject. Our algorithm also does not address how to manage specific failures of treatment; however, it could be assumed that when a patient failed antibiotic-only therapy, the next step would be percutaneous drainage. The same principle could be used for failure of percutaneous drainage with the next treatment strategy being surgical therapy. Another drawback of our algorithm and study is that we did not address the role of open surgical drainage for pyogenic liver abscesses. Open surgical drainage was noted by Tan and colleagues[7] to have significantly better outcomes than percutaneous drainage in abscesses greater than 5 cm. Secondary to this we have included open surgical drainage as an appropriate treatment for the large, multiloculated abscesses. Although we believe that liver resection that can be performed safely with minimal morbidity and mortality is optimal treatment for a large, multiloculated abscess, we cannot assess its efficacy compared with open surgical drainage, because we did not evaluate this in our study. In cases in which large, multiloculated abscesses span the anatomic partition of the right and left lobes, surgical resection would be less desirable and open surgical drainage should be performed. Clearly, further study is needed to test our algorithm using the treatment strategies proposed, including long-term outcomes, comparisons between open surgical drainage and resection, morbidity and

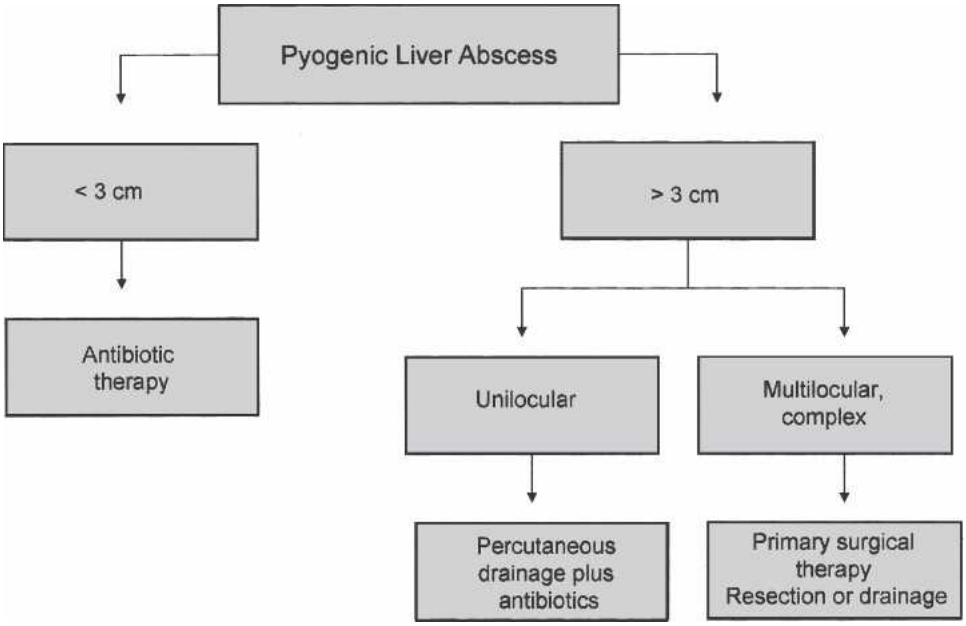

FIG. 5. Proposed algorithm for treatment of pyogenic liver abscesses.

mortality rates, and quality-of-life assessments, to ensure that we are optimally treating this rare disease process in the most efficient, minimally invasive, and patient-friendly manner.

In conclusion, for large, multiloculated complex pyogenic liver abscesses, we found that primary surgical therapy with liver resection resulted in a significantly better success rate than percutaneous drainage plus antibiotics and has similar mortality rates. We propose that small liver abscesses can be adequately treated with antibiotic therapy alone; large, unilocular abscesses can be treated successfully with percutaneous drainage plus antibiotics; and primary surgical therapy is recommended for larger, complex multiloculated abscesses.

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