PYOGENIC LIVER ABSCESS IN CHILDREN: A LONG TIME HOSPITAL EXPERIENCE

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Abstract- Consensus regarding management of pyogenic liver abscess (PLA) among children is yet to emerge, and documentation on these subjects is scanty. Eighteen cases of PLA admitted at Children's Medical Center in Tehran, Iran, over a 15 year period were analyzed to document the clinical profile and to evaluate the management of PLA among children. Records of all patients were reviewed for presenting signs and symptoms, any associated condition, investigative results, management, and follow–up findings. The overall rate of PLA was 48.9 per 100,000 pediatric admissions in our hospital. Moderate to severe malnutrition was present in five (27.8%) and ascariasis in seven (38.9%) children. Common presentations were fever (100%), abdominal pain (76.9%), and tender hepatomegaly (83.3%). Fourteen patients (77.8%) had solitary liver abscess. Organism was isolated in 11 cases (63.3%), and *staphylococcus aureus* was the commonest isolate (66.7%).Twelve cases were managed conservatively with antibiotics alone, of these only two (16.7%) required drainage later. Percutaneous aspiration was also undertaken in four additional (22.2%) cases and open drainage in two (11.1%), at presentation. The overall mortality rate was 11.1%. Time taken for complete resolution ranged from 10 to 40 days. Altogether, we conclude that any child presenting with fever, abdominal pain, and tender hepatomegaly should be subjected to ultrasound scan for early detection of PLA. It seems that a combination of cloxacillin and gentamicin or a third generation cephalosporine and gentamicin, especially in infants, is a satistactory initial coverage. Therapeutic drainage is not an obligation in all cases of PLA. When required, percutaneous needle aspiration is safe and effective. Resolution and significant reduction in mortality has been made possible by early detection and appropriate antibiotic therapy.

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Key words: Liver, pyogenic abscess, children

INTRODUCTION

Pyogenic liver abscess (PLA) in infancy and childhood has been described to be a rare problem, but with high mortality (1,2). Majority of reported cases have occurred among immunocompromised children especially those with chronic granulomatous diseases (3). Only a few cases have been reported among otherwise healthy children, mostly from developing countries of South Africa (4). Prompted by our observation of a number of cases of PLA in otherwise healthy children, we were interested in reviewing all cases of PLA admitted in the pediatric wards of our hospital over the past 15 years. Our interest was further strengthened by the fact that the diagnosis, management, and outcome in PLA in adults has undergone much change over the past few decades with significant reduction in morbidity and mortality (5-7). However, consensus regarding management of PLA among children is yet to emerge, and documentation on these subjects is scanty (8-10).

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MATERIALS AND METHODS

Eighteen patients were admitted in pediatric wards at Children's Medical Center, Tehran, Iran between 1987 and 2002 with the diagnosis of PLA. Cases were included in this retroprospective study if (a) there were hypoechoic lesions in liver and (b) pus was aspirated from these lesions with negative amoebic serology and/or these lesions were cured after adequate antibiotic treatment, and/or bacterial organism from either pus or blood was isolated. For these cases all relevant data were reviewed. Age, sex,

symptoms and their duration, clinical signs at presentation, and any associated conditions were noted. Results of the diagnostic workups including ultrasound findings and organisms isolated, management including details of antibiotic therapy and drainage procedure of any underlying predisposing factors in all these patients at presentation and during follow-up were also included. Temporal profile of the symptoms and lesions as seen on repeated ultrasound examinations during follow-up was also recorded.

RESULTS

In our hospital, the overall rate of PLA was 48.9 per 100,000 pediatric (under 15 years age) admissions. Details of the cases are shown in tables 1,2 and 3. Their age ranged between 3 months to 15 years, with a mean age of 3 years. The overall male to female ratio was 1.6:1. Among associated conditions, five children had moderate to severe protein energy malnutrition. One child had measles in the recent past, and another had aplastic anemia and was on long-term steroid therapy. None of the patients had any features suggestive of chronic granulomatous disease or other immunologic disorders. History of passing worms was present in 10 (55.5%) cases, and stool examination results were positive for Ascaris lumbricoides ova in seven (38.9%) and Hookworm ova in four (22.2%) cases. All patients were symptomatic at presentation, and the duration of symptoms varied from 7 days to 60 days. All the patients had fever. Of the 13 children who could complain, abdominal pain was present in 10 (76.9%). Tender hepatomegaly was present in 15 cases (83.3%), and four patients (22.2%) had palpable swelling in right hypochondrium. There were two patients who had associated multiple pyogenic subcutaneous abscesses. Both these patients were otherwise found to be healthy. Congestive heart failure was present in two patients, one had associated myocarditis and the other one had severe anemia. Three patients (cases 3,17 and 18) had septicemia with septic shock. Ultrasound scan was performed in all 18 patients with 100% positivity. Lesions were hypoechoic in all and round to oval in 16 patients (88.9%). Margins were mostly irregular (55.5%) and hypoechoic (72.2%). Twelve (66.0%) patients had internal echoes of varying intensities and patterns. Number and location of abscesses and other investingative findings are shown in Table 4.

Table 1. Clinical findings of patients

Case No.	Sex, Age (yr)	Presenting Symptoms and Signs	Associated conditions
1	M , 5	Fever, abdominal pain, tender hepatomegaly	Multiple subcutaneous pyemic abscess
2	F, 3	Fever,swelling of right hypochondrium,abdominal pain, tender hepatomegaly	None
3	F, 7/5	Fever, abdominal distension, pedal edema, hepatomegaly	Septicemia, PEM, postmeasle's state
4	M , 5	Fever, multiple tender subcutaneus swelling, tender hepatomegaly	Multiple subcutaneous pyemic abscess
5	F, 3	Fever, abdominal distension and pain, pedal edema, increased JVP, tender hepatomegaly	Pyopericardium, pleural effusion, PEM
6	M , ½	Fever, epigastric pain and swelling, tender hepatomegaly	None
7	M , 1½	Fever, abdominal distension, tender hepatomegaly	None
8	F, 5	Fever, tender hepatomegaly, pain of abdomen	Right basal pneumonitis
9	M , 3	Fever, breathlessness, hepatomegaly	None
10	M , 15	Fever, diarrhea, abdominal tenderness, hepatomegaly	Gastroenteritis, pneumonitis, aplastic anemia on steroids
11	M , 2	Fever, breathlessness, dysentery, tender hepatomegaly	Gastroenteritis, penumonitis, PEM, hydrocephalus
12	M , 14	Abdominal pain, tender hepatomegaly	None
13	F, 9	Fever, pain and swelling in right hypochondrium, tender hepatomegaly	None
14	M , 5	Fever, abdominal pain, tender hepatomegaly	Collection in subdiaphragmatic space, pneumonitis
15	M , 3½	Fever, abdominal distension, hepatomegaly	Peritonitis, PEM
16	M , 8	Fever, abdominal pain, increased JVP, pedal edema, tender hepatomegaly	Anemia with CCF
17	M , 5	Fever, pedal edema, abdominl pain	Myocarditis with CCF, septicemia
18	F, 1	Fever, diarrhea, hepatomegaly	Gastroenteritis,septicemia, PEM

Abbreviations: PEM , Protein energy malnutrition; CCF, Congestive cardiac failure; M, Male; F, Female; increased JVP, Increased Juguler Venous Pulse.

An organism was isolated from blood, pus, or both in eleven cases (61.6%). *Staphylococcus aureus* was the commonest (63.6%) organism isolated. Anaerobic culture was done in four patients and results were negative in all. All the patients received antibiotics as soon as diagnosis of PLA was suspected. It was given intravenously for 2 weeks and continued for 2 more weeks orally. Antibiotic combinations are shown in Table 3. Twelve (66.7%) patients were started on conservative management with antibiotics alone. Metronidazole was added to the initial antibiotic regimen in six cases. In four of these cases both pus and blood culture were sterile, and response was unsatisfactory. One case (case 7) had foul-smelling pus, and another (case 3) continued to deteriorate thereby making the possibility of anaerobic etiology stronger. Further intervention was required in two patients on conservative therapy. Both (cases 11 and 13) had large abscess that failed to respond, and one of these (case 13) ultimately required open drainage. Therapeutic percutaneous drainage was electively undertaken at presentation in four (22.2%) more cases (cases 7, 9, 12 and 17). Criteria for the elective percutaneous aspiration was mainly existing large abscess with impending rupture or when the patient was very sick.

Open drainage at presentation was undertaken in two (11.1%) patients (cases 2 and 15), whereas another patient (case 13) required open drainage because of continuous deterioration in spite of antibiotics and percutaneous aspiration. Indication for the open drainage in one was peritonitis, whereas the other (case 2) underwent open drainage because it was the trend in those days. Two patients (cases 3 and 17) died, giving an overall mortality rate of 11.11%. One child (case 3) had septicemia with septic shock at admission, with recent history of measles, whereas the other (case 17) had typhoid with liver abscess and myocarditis. Fifteen (83.3%) patients had at least one follow-up ultrasound imaging of the lesion, and in all these patients, lesions were resolving. Ten patients were followed up until complete resolution. The time required for complete resolution ranged from 15 days to 45 days. None of the patients experienced relapse.

Table 2. Laboratory findings of patients

Case No.	Location and No. of Abscess	Organisms Isolated	Hematologic investigations
1	Right lobe, single, 4×5 cm	Pus, *S. Aureus*; Blood, sterile	TLC: 22,000, DC: N48E2L50
2	Right lobe, single, 5×4 cm	Blood, sterile; Pus, sterile	TLC: 180.000, DC: N72E4L24 ALT: 22IU/L, AP: 240IU/L
3	Both lobes, multiple. 2×2 cm	Blood, *E. coli*	TLC: 180,000 ,DC: N30L69E1 PS-Sepsis
4	Right lobe, single, 4×4.7 cm	Pus, *S. aureus*	TLC: 9,600 ,DC: N58E12L30
5	Right lobe, single, 4.4×6.7 cm	Blood, *S. aureus*; Pus, sterile	TLC: 32,000 ,DC: N41L59
6	Left lobe, single, 3.6×3.6 cm	Pus, *S. aureus*; Blood, sterile	TLC: 22,000, DC: N53E7L40 ALT:50IU/L, AP:170IU/L
7	Right lobe, single, 8.6×6.4 cm	Blood, *S. aureus*; Pus, sterile	TLC: 45,000, DC: N57L43 AP: 4490IU/L, ALT:80IU/L
8	Right lobe, single, 4×4 cm	Blood, sterile; Pus, sterile	TLC: 26,000, DC: N78E2L20
9	Right lobe, single, 6.8×7.2 cm	Pus, sterile; Blood, sterile	TLC: 11900, DC: N24E1L75
10	Right lobe, single, 3×3 cm	Blood, sterile	TLC: 6800 , DC: N20L72M8
11	Right lobe, single, 8×7.5 cm	Pus, sterile; Blood, sterile	TLC: 28,000, DC: N80L20 AP:160IU/L
12	Left lobe, single, 4×4 cm	Pus, *S. aureus*; Blood, sterile	TLC: 10,000 ,DC: N56E4L40 AP:250IU/L, ALT:15IU/L
13	Right lobe, single, 10×10 cm	Pus and Blood, *S. aureus*	TLC: 11,000,DC: N48E2L50 AP:303IU/L, ALT:75IU/L
14	Right lobe, single, 2×4 cm	Blood, sterile	TLC: 9,000, DC: N68L32
15	Right lobe, single, 3.5×3.6 cm	Blood, *K. pneumoniae*; Pus,sterile	TLC: 70,000, DC: N85L15
16	Both lobes, multiple, 1.5×1 cm	Blood, sterile	TLC: 38,700 ,DC: N87E2L9M2 AP:250IU/L, ALT:25IU/L
17	Right lobe, multiple 1×1 cm	Blood, *S. typhi*	TLC: 8,000 ,DC: N40E2L58 ECG-myocarditis
18	Both lobes, multiple, 0.8×0.7cm	Blood, *K. pneumoniae*	TLC: 20,000 ,DC: N78L22

Abbriviations:Ps, Peripheral smear; AP, alkaline phosphatase (normal, 150-20IU/L); ALT, alanine-amino-transferase (normal, 15-50I U/L); TLC, total leukocyte count (mm^3); DC, Differential count (%); N, Neutrophil ; E, eosinophil; L, lymphocyte.

Table 3. Management of patients

Case No.	Treatment		Follow-up and outcome
	Antibiotics	Drainage	
1	Cloxacillin + gentamicin	None	Resolution*-D20, afebrile- D10
2	Ampicillin+gentamicin+metronidazole	Open drainage	Resolution-D10, afebrile- D5
3	Cloxacillin+gentamicin+metronidazole	None	Died-D3
4	Cloxacillin + gentamicin	None	Resolution-D30, afebrile- D7
5	Cloxacillin + gentamicin	None	Resolution-D35, afebrile- D15
6	Cloxacillin + gentamicin	None	Resolution-D15, afebrile- D3
7	Ampicillin+gentamicin+metronidazole	Percutaneous aspiration	Resolution-D30, afebrile- D10
8	Cloxacillin + gentamicin	None	Resolution-D30, afebrile- D7
9	Ampicillin+gentamicin+metronidazole	Percutaneous aspiration	Resolution-D13, afebrile- D5
10	Ampicillin + gentamicin	None	Resolution-D30, afebrile- D5
11	Cloxacillin+gentamicin+metronidazole	Percutaneous aspiration	Resolution-D30, afebrile- D7
12	Cloxacillin + gentamicin	Percutaneous aspiration	Resolution-D20, afebrile- D5
13	Ampicillin changed to Colxacillin+gentamicin	Percutaneous aspiration and later open drainage	Resolution-D16, afebrile- D5
14	Ampicillin + gentamicin	None	Resolution-D20, afebrile- D9
15	Cefotaxime + gentamicin	Open drainage	Resolution-D10, afebrile- D5
16	Cloxacillin+gentamicin+metronidazole	None	Resolution-D30, afebrile- D15
17	Ampicillin + gentamicin	Percutaneous aspiration	Died-D2
18	Cefotaxime + gentamicin	None	Resolution-D7, follow-up lost

Abbriviation:D,day

* Resolution was defined as complete disappearance of abscess cavity, based on last ultrasound examination.

Table 4. Imaging and investigative findings

Investigations	Positive finding	%
Ultrasound (n = 18)		
Single abscess	14	77.8
Right lobe	12	66.7
Left lobe	2	11.1
Multiple abscess	4	22.2
Blood culture (n = 17)	7	41.2
Pus culture (n = 12)	5	41.7
Chest X-ray (n = 18)		
Raised Right dome of diaphragm	5	27.8
Pneumonitis	4	22.2
Leukocytosis (n = 18)	11	61.1
Raised liver enzymes (n = 7)		
Alanine transaminase	2	28.6
Alkaline phosphatase	5	71.4

DISCUSSION

The incidence of PLA among infants and children has been variously reported from 3 to 25 per 100,000 pediatric hospital admissions (11,12). Mehta et al had reported on 10 patients with PLA among 18,024 admitted children (under 10 years of age) during the 1981 to 1985 period (13). The relatively high incidence (48.9 per 100,000 pediatric admissions) of PLA in the present study could be because of the high incidence of pyogenic skin and systemic infections and widespread malnutrition (14,15). Moreover, this institution is a referral center for many satellite hospitals, and there is routine use of ultrasonography in the workup of febrile patients with hepatomegaly. High prevalence of worm infestations especially ascariasis could also be a contributory factor (16-18). Several studies have incriminated ascariasis as a factor for PLA. Although 55.5% of our patients had a history of passing worms and 38.9% had stool positive for the ova of *A. lumbricoides*, the general population had similarly high prevalence of worm infestation. Thus, it is difficult to say whether worm infestation predisposes to PLA.

In reports from the developed countries, 40% to 45% of PLA occurred among the immuno-compromised patients (19,20). However, the majority of our patients were otherwise healthy, except for moderate to severe protein energy malnutrition in five children. A few other studies, mostly from developing countries, have also documented several cases of PLA among otherwise healthy children. One patient recently had measles. There have been earlier reports of PLA after measles.

Fever, abdominal pain, and tender hepatomegaly were present in the majority of cases. This was the

observation in several other studies (21,22). Ultrasound scan was found to be sensitive in detecting and localizing abscesses. The role of ultrasound scan in adults with PLA is well documented, but little has been reported in the pediatric age group. Several ultrsonographic features are described to be suggestive of PLA. These include round to oval hypoechoic lesions with irregular echo poor margins, internal echoes and a ring of hypoechogenic liver edema surrounding the lesion. In the present study not all these features were universally present and they lacked specificity. This has also been noted in other studies. However, diagnosis of PLA could be established in all cases with ultrasound features in conjunction with other laboratory findings. Ultrasonography was equally useful in the follow-up of these patients. With successful treatment there was a progressive decrease in the size of the abscesses.

Anaerobic organisms are increasingly being reported as a causative agent in PLA in both adults and children. The anaerobic organisms isolated from children are *peptostreptococcus*, *bacteroides* species, microaero-philic streptococci and others. Thus, anaerobes are the third major group of causative organisms in PLA after *staphylococcus aureus* and enteric gram-negative organisms. The low isolation rate of organisms in our study could partly be caused by prior antibiotic therapy before admission and nonavailability of facility for anaerobic culture in most cases in the initial years. *S aureus* accounted for the greatest proportion of the total isolates as also reported in other studies. *Staphylococcus* was a common cause, both among the immunocompetent and the immunocompromised patients. In infants, *Escherichia coli* and Klebsiella were also impotant causal agents, as in earlier reports.

A penicillinase-resistant penicillin such as cloxacillin with aminoglycoside with or without metronidazole is an appropriate initial antibiotic regimen in children beyond infancy. Of the nine patients started on this regimen, eight showed improvement and only one child (case 3) who had presented with septic shock died on the third day of admission. Among seven patients treated with ampicillin and gentamicin, one patient had worsened necessitating open drainage and antibiotic change, whereas another patient who presented with typhoid myocarditis and septic shock died on the third day after admission. A third generation cephalosporin such as cefotaxime and aminoglycoside would be a good alternative in infants.

Drainage is no longer considered as an obligation in all cases of PLA in adults. But in pediatrics, most reported series have advocated percutaneous catheter drainage of therapeutic needle aspiration. However, 10 (55.5%) of our 18 patients did not require drainage and all but one (case 3) showed resolution on follow-up. A Few other studies have also shown good outcome with conservative management. The mortality rate (11.2%) at this center was lower than those reported in earlier series. Mortality is likely to be higher during infancy and in immunodeficient individuals. The time required for complete resolution, which ranged from 10 days to 40 days, did not show any significant difference among patients with or without drainage procedure.

In conclusion, a combination of penicillinase-resistant penicillin such as coloxacillin and an aminoglycoside is a good initial coverage for PLA in children in developing countries (23). Combination of a third generation cephalosporin and an aminoglycoside is a good alternative in infancy. Metronidazole may be added if the response is unsatisfactory or culture yields anaerobes. Abscess drainage is warranted in cases with large abscesses, in which there is risk of rupture or when there is lack of response after 48 to 72 hours of appropriate antibiotic therapy. Percutaneous aspiration is safe and effective and also avoids the problems of open drainage (24,25).

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