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Assessment of the Management of Ascites in Pediatrics in Jafar Ibn Auf Pediatrics Hospital: A Descriptive Retrospective Study

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Abstract:

Background: Ascites are pathological conditions characterized by the accumulation of fluids in the peritoneal cavity. Ascites are among the most common complications of different diseases in pediatrics, such as renal diseases, cardiac diseases, and hepatic diseases. The pediatric group is considered a vulnerable category needing special care, so assessing the management of ascites in pediatrics needs to be addressed.

Aim: The study was conducted to assess ascites' management in pediatrics in Jafar Ibn Auf pediatric hospital.

Methods: A descriptive retrospective study was conducted at Jafar Ibn Auf pediatric hospital, Khartoum, Sudan. All medical files of pediatrics with ascites from 1 month to 18 years old during the period between 2017-2020 were included. Data were collected from file records using a predesigned data collection sheet and analyzed using the statistical package for the social sciences (SPSS) version 23.

Results: A total of 143 medical records were included in this study. The majority of the group were males. The most affected patients were within the age group of < 6 years old. Grade I was the most common presentation. Hepatic diseases and gastrointestinal diseases were the main etiological factors for ascites and represented in 62.2% and 15.4%, respectively. Regarding ascites management, the most frequent method of managing ascites used was medications with liver support. Moreover, 63.2% of the patients were treated by

combining spironolactone with furosemide. Out of the 143 patients, 92.3% of patients were discharged from the hospital, while the remaining were referred to other hospitals. Statistically, there was a strong association between the grade of ascites, management of ascites, and the patient's discharge (P = 0.001).

Conclusion: The results showed that liver diseases were the most common etiological cause of ascites in pediatrics. The majority of patients were treated properly managed in term of dose, and the combination of spironolactone and furosemide were the most frequently used medications in this study. The proper diagnosis and appropriate management of ascites is critical to prevent related morbidity and mortality in pediatrics.

Keywords: Ascites, Pediatrics, Liver disease, Management, Sudan.

Introduction:

Ascites in children are pathological conditions characterized by the accumulation of fluids in the peritoneal cavity [1]. The most common causes of ascites in children are hepatic, renal, and cardiac diseases [2]. The main key of ascites formation is sodium and water retention, and three theories suggest the mechanism by which this retention occurs; Overflow theory, underfilling theory, or peripheral arterial vasodilatation theory [3]. Ascites can be diagnosed by fatigue, loss of appetite, abdominal distension with full flanks, dyspnea, generalized abdominal pain and/or lower limb edema, and positive shifting dullness in physical examination or imaging examination [3,4] The nature and volume of ascites can be evaluated by medical history, physical examination, laboratory investigations, abdominal imaging examination, and diagnostic paracentesis [4]. According to the international club of ascites, ascites is classified into Uncomplicated ascites, which are not associated with infection or hepatorenal syndrome, and it is classified into three grades based on severity to mild, moderate, and massive ascites. Refractory ascites, which are ascites that do not respond to the dietary sodium restriction and diuretics treatment, or recurrent ascites after large-volume paracentesis, are divided into two subtypes diuretic-resistant and diuretic intractable [5].

The main point in treating ascites is the treatment of the underlying cause. Mild ascites does not need specific treatment, while in moderate ascites, the main idea for the management is initiating a negative sodium balance by sodium intake restriction and increasing sodium excretion by diuretics [2,6]. International guidelines in the management of ascites in pediatrics stated that spironolactone could be used as a monotherapy in case of the first episode of ascites. It can be combined with furosemide as initial therapy in refractory ascites, then shifting to monotherapy

after obtaining a satisfactory response. Preferred management of large ascites is a large volume paracentesis (LVP) up to 100-150ml/kg replaced by albumin infusion 20% and furosemide daily with careful monitoring of electrolytes. In the case of refractory ascites LVP, trans jugular intrahepatic portosystemic shunt (TIPS), peritoneovenous shunting (PVS), and liver transplantation need to be considered [2, 6].

The pediatric group is considered a special category needing special care, and there are not enough studies are focusing on this category considering this aspect. In Sudan, this study is considered the first study to be carried out to assess the management of ascites in pediatrics in Jafar Ibn Auf pediatric hospital to reflect the current situation.

Methods:

Study design:

A hospital-based retrospective observational study was conducted at Jafar Ibn Auf pediatric hospital, Khartoum, Sudan. This hospital is a referral hospital for pediatrics, which include 9 inpatient wards: general, cardiology, respiratory, hematology, gastroenterology, nephrology, nursery, endocrinology and neurology wards [7].The study was included all file records from 2017 to 2020.

Patient selection:

All the file records of the pediatrics in the gastrointestinal department at Jafar Ibn Auf pediatric hospital with ascites aged one month to 18 years old during the period between 2017 and 2020 were included.

Data collection tool:

Data were extracted from the file records using a self-structured validated data collection sheet that included socio-demographic, clinical data, diagnosis, ascetic fluid analysis, management protocol, and clinical outcomes.

Outcome measures:

Determination of the severity of the ascites is essential in determining the management method. According to the international club of ascites, grade I ascites is with small volume of fluid, Grade II ascites have a moderate volume of fluid, and grade III ascites are ascites with a large volume of fluid [5].The assessment was based on the guidelines in the management of ascites in pediatrics, which stated that: the most commonly used diuretics in children are spironolactone, a potassium-sparing aldosterone receptor antagonist diuretic [2,6]. Dosing: [1 month-11years] starting dose of 1-3 mg/kg/day in 1-2 divided doses with scaling up of the dose every 3-5 days up to a maximum of 9mg/kg/day, better to be given as a single morning dose] and furosemide; a loop diuretics. Dosing:[1month-11years] starting dose 0.5-2mg/kg/dose given 2-3 times a day stepped up by 0.5-1mg/kg/day to a maximum of 6mg/kg/dose, better to be given in two doses in the morning and

noon] either as a monotherapy or in combination [2, 6].

Statistical analysis:

All analyses were performed using the Statistical Package for Social Sciences (SPSS) version 23 (SPSS Inc., Chicago, IL). Descriptive statistics were performed; categorical variables were expressed in percentages and frequencies, s. Association between variables was carried out using the chi-square test. P-value of less than 0.05 was considered statistically significant in all analyses.

Ethical considerations:

Ethical clearance was obtained from the Faculty of Pharmacy, University of Khartoum. Ethical approval was also obtained from the health research department, ministry of health, Khartoum state. Before conducting the study, an additional agreement was collected from the administration of Jafar Ibn Auf pediatric hospital. All collected checklists were coded to ensure confidentiality throughout the study.

Results:

A total of 143 confirmed cases of ascites in pediatrics were included in this study period. Of them, 78 (54.5%) were males, 65 (45.5%) were females. The most affected patients 64 (44.8%) were within the age group of 1-5 years old, followed by 39 (27.3%) patients within 6-10 years old (Table 1). The majority of the participants 93 (65%) belonged to families with low socioeconomic status. Clinically, the majority of patients 52 (36.4%) had hospitalization periods ranging from 0-10 days. The most common symptoms were shifting dullness 88 (61.5%), followed by abdominal distension 78 (54.5%) (Table 1).Based on the final diagnosis, the most common etiology of ascites was hepatic disorders 89 (62.2%), followed by gastrointestinal disorders in 22 (15.4%) of patients and metabolic and nutritional disorders in 13 (9.1%) of patients. Regarding ascites grading, 58 (40.6%), 46 (23.2%), and 25 (17.5%) of patients were diagnosed as grade I, II, and III ascites, respectively. While only 6 (4.2%) had refractory ascites, and 8 (5.6%) of patients were with pseudoascites (Table 1).

Table 1. Distribution of socio-demographic and clinical characteristics among the children with ascites (n=143)

Characteristics	Number (Frequency %)
Gender	
Males	78 (54.5)
Females	65 (45.5)
Age (years)	
1- 5	64 (44.8)
6-10	39 (27.3)
11-15	35 (24.5)
> 15	5 (3.5)
Socio-economic status	
Low	93 (65)
Moderate	50 (35)
Length of hospitalization (days)	
0-10	52 (36.4)
11-20	46 (32.2)
21-30	28 (19.6)
31-40	7 (4.9)
> 40	10 (7)
Symptoms	
Abdominal distension with full flank	45 (31.5)
Abdominal distension	78 (54.5)
Abdominal pain	7 (4.9)
Shifting dullness	88 (61.5)
Lower limb edema	33 (23.1)
Generalized body swelling	19 (13.3)
Etiology of ascites	
Hepatic disorders	89 (62.2)
Gastrointestinal disorders	22 (15.4)
Renal disorders	5 (3.5)
Cardiac disorders	2 (1.4)
Metabolic and nutritional disorders	13 (9.1)
Abdominal tuberculosis	6 (4.2)
Others	6 (4.2)
Grades of ascites	
Grade I	58 (40.6)
Grade II	46 (32.2)
Grade III	25 (17.5)
Refractory	6 (4.2)
Pseudo-ascites	8 (5.6)
Patients on chronic medications	
Yes	25 (17.5)
No	118 (82.5)

On clinical examination, ascites was detected in 25(17.5%) patients. Among them, 11 (44%) had a pale-yellow appearance, and 9 (36%) had a milky (chylous) appearance of ascetic fluid (Table 2). In 10 (40%) patients, the fluid was hazy in appearance due to elevated proteins (>2.5g/dl) that suggested infection as causative factor. In addition, only 4 (16%) patients had the serum to ascetic fluid albumin gradient (SAAG) was >1.1. The number of the cells in the ascitic fluid was ≥250x10^6 cells/mm^3 in 12 (48%) patients (Table 2). The most predominant type of cells in the ascitic fluid was lymphocytes which represented in 19(76%) patients, and only one (4%) patient represented both types of cells; lymphocytes and polymorph nuclear cells, with a predominance of polymorph nuclear cells. Gram stain was negative in 24 (96%) patients, and only one (4%) patient was positive (Table 2).Glucose level was ≥30g/dl in 19 (76%) patients, and Triglyceride was elevated (≥400mg/dl) in 9 (36%) patients, and only 3 (12%) patients represented elevated level of lactic dehydrogenase (≥400 sigma unit (SU)) (Table 2).

Table 2. Ascetic fluid analysis among the children with ascites

Parameters	Number (Frequency %)
Ascetic fluid analysis (n= 143)	
Done	25 (17.5)
Not done	118 (82.5)
Results of the ascetic fluid analysis (n= 25)	
Gross appearance	
Pale yellow	11 (44)
Brown	2 (8)
Straw pale	3 (12)
Milky/ chylous/ whitish	9 (36)
Total protein	
Normal	15 (60)
Abnormal (>2.5g/dl)	10 (40)
Serum to ascites albumin gradient (SAAG)	
>1.1	4 (16)
<1.1	21 (84)
Number of the cells	
≥250x10^6 cells/mm^3	12 (48)
<250x10^6 cells/mm	13 (52)
Type of the predominant cells	
Lymphocytes	19 (76)
Lymphocytes and polymorph nuclear cells	1 (4)
None	5 (20)
Bacteriological culture	
Positive (gram +ve bacteria)	1 (4)
Negative	24 (96)
Glucose level	

≥30 g/dl	19 (76)
<30 g/dl	6 (24)
Triglyceride level	
≥400 mg/dl	9 (36)
<400 mg/dl	16 (64)
Lactic dehydrogenase (LDH) level	
≥400 sigma unit (SU)	3 (12)
< 400 SU	22 (88)

Concerning the management of ascites, as demonstrated in Table 3, 16 patients received liver support only, while 34 (23.8%) patients were treated just by using medications, and the majority of the patients 58 (40.6%) received medications with liver support. Moreover, 6 (4.2%) patients treated with combination of nutritional support, medications and liver support, while 12 (8.4%) patients managed with liver support, medications and therapeutic paracentesis. With regards of medications, 42 (36.8%) patients were treated with spironolactone alone, whereas 72 (63.2%) patients were treated with combination of spironolactone with furosemide. The proper doses of medications were prescribed in 111 (97.4%) of patients, only 2 (1.8%) patients had received an underdose of medication (Table 3). Regarding paracentesis, it was done in 32 (22.4%) patients, 16 (50%) of them proceeded paracentesis for a diagnostic purpose, 9 (28.1%) of patients proceeded it for a therapeutic purpose, and the rest patients 7 (21.9%) underwent paracentesis for the both diagnostic and therapeutic purposes (Table 3). Following various management approaches 132 (92.3%) of patients discharged and 11 (7.7%) of patients were referred (Table 3).

Table 3. The methods used in the management of ascites and clinical outcomes of the children with ascites (n= 143)

Management	Number (Frequency %)
Management method (n= 143)	
Nutritional support only	5 (3.5)
Medications only	34 (23.8)
Liver support only	16 (11.2)
Paracentesis only	7 (4.9)
Nutritional support + medications	1 (0.7)
Nutritional support + medications + liver support	6 (4.2)
Liver support + medications	58 (40.6)
Liver support + paracentesis	1 (0.7)
Liver support + medications + paracentesis	12 (8.4)
Medications + paracentesis	3 (2.1)
Type of used medications (n= 114)	
Spironolactone	42 (36.8)
Spironolactone + Furosemide	72 (63.2)
Appropriateness of medication doses (n=114)	
Proper dose	111 (97.4)
Under dose	2 (1.8)
Over dose	1 (0.9)
Purpose of paracentesis (n= 32)	
Diagnostic	16 (50)
Therapeutic	9 (28.1)
Diagnostic + Therapeutic	7 (21.9)
Outcomes (n= 143)	
Discharged	132 (92.3)
Referred	11 (7.7)

Discussion:

Younger children are more likely to have ascites than older children due to age-specific considerations; renal function parameters, body surface area, fluid and nutritional requirements, and growth factors [8]. In this study, the most affected patients were one month to 5 years old. Similar to the findings of the study by Karnsakul, et al. Where the most affected children were of the age group <5 years [12]. Females have around 20 ml of abdominal fluid, which may indicate that females are more likely to have ascites than males [9]. The majority of the affected patients in the study were found to be males, similar to the findings of a previous study where the maximum number of the affected patients were males [10].

Clinically, the higher percentage (36.4%) represented in the least hospitalization period, which reflected that the proper diagnosis and management of ascites in the patients play an

essential role in the duration of hospitalization. Furthermore, ascites characterized by abdominal distention with full flanks, abdominal distension, lower limb edema, generalized abdominal pain and/or shifting dullness [5]. The most common symptoms were shifting dullness, abdominal distension, abdominal distension with full flank and lower limb edema. These findings differ from a previous report in which that the most common symptoms of ascites in children were abdominal distension, facial puffiness, pedal edema and generalized body swelling [11]. Etiologically, liver diseases represent the main cause of ascites in pediatric diseases [12]. We also found that the most common cause of ascites was liver diseases, such as chronic liver disease, cholestatic jaundice, autoimmune hepatitis, and liver cirrhosis. Other etiologies were esophageal varices, abdominal tuberculosis, lymphoma, and nephrotic syndrome.

It is crucial to determine the severity of the ascites in order to determine the appropriate management method. According to the international club of ascites; grade I ascites contain a small volume of fluid, Grade II ascites have a moderate volume of fluid, and grade III ascites have a large volume of fluid [5]. In the current study, 40.6%, 32.2%, and 17.5% of patients were diagnosed as grade I, II, and III of ascites, respectively. These findings align with a previous study that showed grade I ascites were the most common presentation [12]. Furthermore, ascetic fluid analysis can help determine the underlying disease; it was only performed in 17.5% of patients; from them, nine patients had milky appearance of ascetic fluid, which reflects cirrhosis or lymphoma. Two patients had brown appearances suggesting hyperbilirubinemia, three patients had straw-colored appearances suggesting malignancy, abdominal trauma, or invasive investigation, and eleven patients presented with pale yellow appearances indicating portal hypertension. These findings contrast Talawar K. et al. study that concluded that ascetic fluid analysis was done in 48 patients and only one patient had milky appearance [10].

Management of ascites differs according to the severity or grades of ascites [6]; in this study, grade I ascetic patients received different management techniques and 57 of them were released from the hospital, and only one patient was transferred. Ascetic patients in Grade II were also treated differently; 39 were discharged and seven were referred. In contrast, treatment of grade III patients indicated that 24 patients were discharged, and only one patient was referred. The combined therapy of medications with liver support was the most frequently used method in managing the different grades of ascites. In combination with medications and liver support, paracentesis was more frequently used to manage

ascites grade III (5 patients) and refractory ascites (4 patients).

Commonly used diuretics in children are spironolactone and furosemide. Spironolactone is more effective than furosemide, but it has a slow onset of action, so dual therapy with spironolactone and furosemide is more effective in mobilizing fluids and shortens the hospitalization period [1,4]. In this study, spironolactone and furosemide are used more frequently in 63.2% of patients, while monotherapy of spironolactone alone was used in 36.8% of patients. Karnsakul et al. reported that spironolactone was more frequently used in patients with intrahepatic diseases than other etiologies, while furosemide was used more frequently in patients with congestive heart failure nephrotic syndrome [13]. According to guidelines in the management of ascites in pediatrics, most of the patients received the correct dose, and only two patients received an underdose and one received an overdose.

The current study has some limitations. Firstly, the retrospective design of the current study was limited by incomplete files and missing information. The second limitation is that the study was conducted in a single center, which means it may not be possible to generalize these findings. Thus, we strongly recommend conducting multicenter studies to determine the exact incidence and prognosis of Sudanese ascites in pediatrics. In addition, we highlight the gab and problems of implementing the national guidelines to treat ascites in Sudanese pediatrics.

Conclusion:

The most common causes of ascites in pediatrics in the conducted study were liver diseases. The combined therapy of medications with liver support was the most frequently used method in managing the different grades of ascites. There is a strong correlation between the grade of ascites, the management method, and the outcome of ascites patients. The combination of spironolactone and furosemide was the most frequently used medication.

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