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Comparative Utility of SAAG (Sero Ascitic Albumin Gradient), AFTP (Ascitic Fluid Total Protein), AFLDH (Ascitic Fluid Lactate Dehydrogenase), and Other Biochemical Parameters In The Evaluation of Ascites In Children

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Abstract: *Ascites can be defined as the abnormal accumulation of fluid inside the peritoneal cavity. Earlier ascites was classified as transudative and exudative based on the total protein concentration of the ascetic fluid. To study comparative utility of serum ascites albumin gradient (SAAG), Ascitic fluid total protein, (AFTP), Ascitic fluid lactate dehydrogenase (AFLDH), Ascitic fluid / serum total protein (AFTP/STP), Ascitic fluid / Serum LDH (AFLDH/SLDH), serum and ascitic cholesterol in the differential diagnosis of ascites. 48 cases of ascites were studied for a period of 10 months extending from May 2016 to Feb. 2017 (Our cases constituted mainly Hospital admissions in the Department of Pediatrics consisting of 3 units, RIMS General Hospital, Kadapa.)*

Keywords: *serum ascites albumin gradient, Ascitic fluid total protein, Kadapa, serum total protein*

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I. Introduction

Ascites can be defined as the abnormal accumulation of fluid inside the peritoneal cavity. Earlier ascites was classified as transudative and exudative based on the total protein concentration of the ascetic fluid. The traditional concept of high protein ascites(> 2.5 g/dl) as exudate was questioned because: [1]
(a) the normal peritoneal fluid protein concentration is some times > 4 g/dl;
(b) the ascitic fluid protein concentration increases in cirrhotic patients with diuresis and albumin infusion);
(c) some transudative ascites like cardiac ascites have high protein concentration while some traditionally exudative ascites like malignant ascites have low concentration of protein;
(d) moreover cirrhosis may be the most frequent cause of high protein ascites.

II. Aims & Objectives

To study comparative utility of serum ascites albumin gradient (SAAG), Ascitic fluid total protein, (AFTP), Ascitic fluid lactate dehydrogenase (AFLDH), Ascitic fluid / serum total protein (AFTP/STP), Ascitic fluid / Serum LDH (AFLDH/SLDH), serum and ascitic cholesterol in the differential diagnosis of ascites

III. Materials And Methods

48 cases of ascites were studied for a period of 10 months extending from May 2016 to Feb. 2017 (Our cases constituted mainly Hospital admissions in the Department of Pediatrics consisting of 3 units, RIMS General Hospital, Kadapa.) All cases were studied in detail by taking detailed history and clinical examination. Before any therapeutic intervention, diagnostic paracentesis of abdomen was done. The samples of ascitic fluid and venous blood were obtained in the same sitting. These were analysed for total protein, albumin, LDH and cholesterol with enzymatic assays in an autoanlyzer. Ascitic fluid was also analyzed for cellcount, cytology and cultures. Cirrhosis of liver and other liver causes were diagnosed by liver function tests, ultrasound abdomen, upper GI endoscopy, viral serology and Wilson's profile wherever indicated.

Nephrotic syndrome was diagnosed by urine albumin, 24 hr urine protein, serum cholesterol and spot urine protein / creatinine ratio. TB peritonitis was diagnosed by Mantoux test, chest X-ray, Ascitic fluid ADA>35 U/lit level and ultrasound abdomen wherever indicated. Cardiac ascites was diagnosed by chest X-ray, ECG and Echocardiography Bacterial peritonitis was diagnosed by ascitic fluid cell count and culture studies (cell count of 500 / cubic mm, neutrophil concentration of 250 / cubic mm).

We assessed the accuracy of SAAG>1.1 gm/dl in detecting portal hypertension and AFTP > 2.5 gm/dl, AFTP/STP >0.5, AFLDH/SLDH >0.6 in detecting an exudate. The accuracy of serum cholesterol > 220mg% in detecting nephrotic syndrome was assessed. Ascitic cholesterol was also assessed for any significance in its variability. Mean values were estimated for all biochemical parameters and statistical significance of difference between means was estimated by standard "t" test.

IV. Results

Table - 1 Sex Wise Incidence Of Ascites

Sex	No of cases	Percentage
Male	27	56.25%
Female	21	43.75%
Total	**48**	**100%**

From the above analysis the incidence of ascites was more common in male children comprising of 27 cases (56.25%). The incidence in female children was 21 cases (43.75%).

Table - 2 Age Wise Incidence Of Ascites

Age in years	No of cases	Percentage
<3	4	8.33%
3-6	23	47.9%
6-12	21	43.75%
Total	48	100

The above table showed 4 cases that were recorded below 3 years of age comprising of 89.33%, 23 cases were recorded in between 3-6 years comprising of 47.9% and 21 cases were reported in between 6-12 years of age comprising of 43.75%. The incidence of ascites was more common after 3 years consisting of 44 cases (>90%). The highest incidence after 3 yrs might be due to increased incidence of Nephrotic syndrome, cirrhosis of liver etc.

Table - 3 Etiolological Incidence Of Ascites

Sl. No.	Etiology	No of cases	Percentage
1.	Nephrotic syndrome	20	41.67%
2	Cirrhosis of liver	12	25%
3	Tuberculous peritonitis	7	14.58%
4	Congestive heart failure	3	6.25&
5	Nephrotic syndrome with Spontaneous bacterial peritonitis	3	6.25%
6	Cirrhosis with SBP	1	2.08%
7	Non cirrhotic portal fibrosis	1	2.08%
8	SLE	1	2.08%
	Total	48	100

From the above analysis it is showed that most of the cases of ascites were caused by nephrotic syndrome comprising of 41.67% (20 out of 48 cases). Cirrhosis of liver consisting of 12 cases (25%), Tuberculous peritonitis 7 cases (14.58%), congestive heart failure 3 cases (6.25%), nephrotic syndrome with SBP 3 cases (6.25%) and others comprising of 1 each. So, the incidence of nephrotic syndrome causing ascites was high because it is an immune mediated disease which is difficult to prevent. The incidence of cirrhosis and tuberculous peritonitis were also high next to that of nephrotic syndrome.

Table - 4 Values Of Diffeent Parameters In Different Cases Of Ascites

	AFTP		SAAG		AFLDH		AFTP/STP		AFLDH/SLDH		S.CHO		A.CHO	
Diagnosis	Avg +SD	Range	Avg +SD	Range	Avg +SD	Range	Avg +SD	Range	Avg +SD	Range	Avg +SD	Range	Avg +SD	Range
Nephrotic Syndrome	1.67 +1.4	0.1 -6.8	0.8 +0.38	0.15 -2	144.74 +292.7	16 - 1356	0.389 +0.264	0.03 - 0.95	0.154 +0.31	0.01 -1.29	352.4 +175.8	9 - 612	16.95 +39.4	0.47 - 163
Cirrhosis of Liver	1.77 +1.42	0.4 -5.5	2.23 +0.56	1.3 - 3.2	131 +88.9	31 - 295	0.3 +0.28	0.06 - 1.14	0.18 +0.14	0.04 -0.52	67.7 +31.3	25 - 113	17.2 +19	0.6 to 59
Tubercul	4.4	2.2	0.68	0.2	687.8	44	0.678	0.36	0.73	0.08	107.2	62	69.5	49

ous Peritonilis	+1.38	-5.7	+0.275	-1.0	+343.5	-924	+0.165	-0.88	+0.38	-1.2	+33.8	to 156	+20.5	to 104
CHF	1.24 +0.197	1.1 - 1.52	2.9 +0.08	2.9 -3	207.8 +6.95	198 - 213	0.21 +0.019	0.2 - 0.24	0.236 +0.008	0.23 to 0.25	96.6 +3.85	93 to 102	13.2 +2.46	10 to 16

Table - 4 Comparison Of Saag And Aftp In Classifying Ascites

Disease	Total No. of cases	SAAG < 1.1gm/dl (Low grad.)	SAAG > 1.1 gm/dl (High grad.)	AFTP < 2.5 gm/dl Transudate	AFTP >2.5 gm/dl Exudate
Nephrotic Syndrome	20	18 (90%)	2 (10%)	16 (80%)	4 (20%)
Cirrhosis of liver	13	1 (7.69%)	12 (92.3%)	9 (69.23%)	4 (30.76%)
Tuberculous Peritonitis	7	7 (100%)	0 (0)	2 (28.5%)	5 (71.42%)
CHF	3	0	3 (100%)	3 (100%)	0
NS with SBP	3	3 (100%)	0	3 (100%)	0
Non cirrhotic Portal fibrosis	1	1 (100%)	0	1 (100%)	0
SLE	1	1 (100%)	0	1 (100%)	0
Total	48	31	17	35	13

Similarly among 3 cases of nephrotic syndrome with spontaneous bacterial peritonitis all the 3 (100%) were having SAAG < 1.1 gm% and AFTP < 2.5gm%.

Table - 5 Comparison Of Saag And Afldh In Classifying Ascites

Disease	Total No. of cases	SAAG < 1.1gm% (Low grad.)	SAAG > 1.1 gm% (High grad.)	AFTP < 200IU/L Transudate	AFTP >200 IU/l Exudate
Nephrotic Syndrome	20	18 (90%)	2 (10%)	16 (80%)	4 (20%)
Cirrhosis of liver	13	1 (7.69%)	12 (92.3%)	9 (69.23%)	4 (30.8%)
Tuberculous Peritonitis	7	7 (100%)	0 (0)	1 (14.28%)	6 (85.7%)
CHF	3	0	3 (100%)	1 (33.3%)	2 (66.6%)
NS with SBP	3	3 (100%)	0	1 (33.3%)	2 (66.6%)
Non cirrhotic Portal fibrosis	1	1 (100%)	0	1 (100%)	0
SLE	1	1 (100%)	0	1 (100%)	0
Total	48	31	17	30	18

The above table showed 16 out of 20 cases of nephrotic syndrome were having AFLDH < 200 IU/lt. comprising of 80% and 4 cases (20%) were having AFLDH > 200 IU/lt. When these findings are compared with those of SAAG the misclassification rate with AFLDH in nephrotic syndrome is 20% and that of SAAG is only 10%. So in nephrotic syndrome SAAG < 1.1 gm% (low gradient) is more specific than applying ascitic fluid LDH.

Among 13 cases of cirrhosis of liver 9 (69.2%) were having AFLDH < 200 IU/lt. where as 4 (30.8%) were having AFLDH > 200 IU/lt. When these findings are compared with SAAG the misclassification rate in cirrhosis with AFLDH is 30.8% and that with SAAG is only 7.69%. So in cirrhosis of liver SAAG>1.1gm% (high gradient) is more specific than applying ascetic fluid LDH. Among 7 cases of tuberculous peritonitis 6 (85.7%) were having AFLDH >200 IU/lt. and 1 (14.28%) was having AFLDH <200 IU/lt. When compared with SAAG, the misclassification rate in tuberculous peritonitis with AFLDH is 14.28% where as that with SAAG is zero.

So in tuberculous peritonitis also SAAG <1.1gm% is more specific than applying AFLDH. Among 3 cases of CHF 2 (66.6%) were having AFLDH >200 IU/lt. and 1 (33.3%) was having AFLDH <200 IU/lt. The misclassification rate with AFLDH in CHF is 66.6% where as with SAAG it is zero. In 3 cases of NS with spontaneous bacterial peritonitis 2 (66.6%) were having AFLDH >200 IU/lt. and 1 (33.3%) was having AFLDH <200 IU/lt. So misclassification in NS with SBP for AFLDH is 33.3% and that for SAAG is zero.

So in CHF SAAG >1.1 gm% is more specific than AFLDH. And in NS with SBP SAAG <1.1 gm% is more specific than applying AFLDH.

Table - 6 Comparison Of Saag And Aftp/Stp In Classifying Ascites

Disease	Total No. of cases	SAAG < 1.1gm % (Low grad.)	SAAG > 1.1 gm%l (High grad.)	AFTP < 0.5 Transudate	AFTP >0.5 Exudate
Nephrotic Syndrome	20	18 (90%)	2 (10%)	13 (65%)	7 (35%)
Cirrhosis of liver	13	1 (7.69%)	12 (92.3%)	11 (84.6%)	2 (15.4%)
Tuberculous Peritonitis	7	7 (100%)	0 (0)	1 (14.28%)	6 (85.7%)
CHF	3	0	3 (100%)	3 (100%)	0
NS with SBP	3	3 (100%)	0	2 (66.66%)	1 (33.33%)
Non cirrhotic Portal fibrosis	1	1 (100%)	0	1 (100%)	0
SLE	1	1 (100%)	0	1 (100%)	0
Total	48	31	17	32	16

The above table showed 13 out of 20 cases (65%) of Nephrotic syndrome were having AFTP/STP <0.5 (Transudate range) and 7 cases (35%) were having AFTP/STP > 0.5 (Exudate range). When these finding are compared with those of SAAG, the misclassification rate with AFTP/STP in nephrotic syndrome is 35% where as that of SAAG is only 10%. So in nephrotic syndrome SAAG <1.1gm% is more specific than applying AFTP/STP. Among 13 cases of cirrhosis 11 (84.6%) were having AFTP/STP <0.5 and 2 (15.4%) were having AFTP/STP >0.5. When these are compared with SAAG, the misclassification rate in cirrhosis with AFTP/STP is 15.4% and that with SAAG is only 7.69%. So in cirrhosis of liver SAAG >1.1 gm% (high gradient) is more specific than applying AFTP/STP.

Among 7 cases of tuberculous peritonitis 6 (85.7%) were having AFTP/STP>0.5 and 1 (14.28%) was having AFTP/STP <0.5. When compared with SAAG, the misclassification rate in tuberculous peritonitis with AFTP/STP is 14.28%, where as that with SAAG is zero. So in tuberculous peritonitis also SAAG<1.1gm% is more specific than applying AFTP/STP. Among 3 cases of NS with SBP 2 (66.66%) were having AFTP/STP <0.5, 1 (33.33%) was having AFTP/STP > 0.5. The misclassification in NS with SBP with AFTP/STP is 66.66% where as with SAAG it is zero percent. So in NS with SBP, SAAG < 1.1 gm% is more specific than applying AFTP/STP. Among 3 cases of CHF; all the 3 (100%) were having AFTP/STP < 0.5 and SAAG >1.1 gm%. So in CHF SAAG and AFTP/STP appear to be equally specific.

Table - 7 Comparison Of Saag And Afldh/Sldh In Classifying Ascites

Disease	Total No. of cases	SAAG < 1.1gm% (Low grad.)	SAAG > 1.1 gm% (High grad.)	AFTP < 0.6 Transudate	AFTP >0.6 Exudate
Nephrotic Syndrome	20	18 (90%)	2 (10%)	16 (80%)	4 (20%)
Cirrhosis of liver	13	1 (7.69%)	12 (92.3%)	11 (84.6%)	2 (15.38%)
Tuberculous Peritonitis	7	7 (100%)	0 (0)	4 (57.14%)	3 (42.85%)
CHF	3	0	3 (100%)	3 (100%)	0
NS with SBP	3	3 (100%)	0	3 (100%)	0
Non cirrhotic Portal fibrosis	1	1 (100%)	0	1 (100%)	0
SLE	1	1 (100%)	0	1 (100%)	0
Total	48	31	17	42	6

The above table showed 16 out of 20 cases of nephrotic syndrome were having AFLDH/SLDH< 0.6 (Transudate range) comprising of 80% and 4 cases (20%) were having AFLDH/SLDH> 0.6 (Exudate range). When these findings are compared with those of SAAG the misclassification rate in nephroticsyndrome with AFLDH/SLDH is 20% where as that with SAAG is only 10%. So in nephrotic syndrome SAAG < 1.1 gm% is more specific than applying AFLDH/SLDH.

Among 13 cases of cirrhosis 11 (84.6%) were having AFLDH/SLDH <0.6 and 2 (15.38%) were having AFLDH/SLDH>0.6. When these results are compared with those of SAAG, the misclassification rate in cirrhosis with AFLDH/SLDH was 15.38% where as that with SAAG was 7.69% only. So in cirrhosis of liver SAAG >1.1gm% (high gradient) is more specific than applying AFLDH/SLDH. Among 7 cases of tuberculous peritonitis 4 (57.14%) were having AFLDH/SLDH <0.6 (Transudate) and 3 (42.85%) were having AFLDH/SLDH >0.6 (Edudate). When these results are compared with SAAG, the misclassification rate in tuberculous peritonitis with AFLDH/SLDH is 57.14% where as that with SAAG is zero percent. So, in tuberculous peritonitis also SAAG <1.1gm% is more specific than applying AFLDH/SLDH.

Among 3 cases of CHF, all the 3 (100%) were having AFLDH/SLDH <0.6. The misclassification rate in CHF with SAAG and AFLDH/SLDH is zero percent. So, in CHF, SAAG and AFLDH/SLDH are equally specific.

In 3 cases of NS with SBP, all the 3 (100%) were having AFLDH/SLDH <0.6 (Transudate). When compared with SAAG, the misclassification in NS with SBP with AFLDH/SLDH is 100%, where as that with SAAG is zero percent. So, in cases of NS with SBP, SAAG <1.1gm% is more specific than applying AFLDH/SLDH.

Comparative efficacy of individual tests (saag, aftp, afldh, aftp/stp, afldh/sldh, serum and ascitic cholesterol) to differentiate different causes of ascites:

When SAAG, AFTP, AFLDH, AFTP/STP, AFLDH/SLDH, Ascitic and serum cholesterol values of all these 48 cases are tabulated and subjected to group statistics using t-test, Mann-Whitney test, and Chi-square test, the p-value for :

SAAG		-0.0001	
AFTP		-0.017	
AFLDH	-0.002		
AFTP/STP		-0.034	<0.05
AFLDH/SLDH	-0.041		
Serum Cholesterol		-0.012	
Ascitic Cholesterol		-0.135 (>0.05)	

The variability of Ascitic cholesterol was found not to be significant.

The sensitivity, specificity, positive, negative predictive values and diagnostic efficacies of all the significant parameters are summarized in the table. (AFTP/STP>0.5 is considered exudate; <0.5 as transudate; AFLDH>200 IU/lt. as exudate, <200 IU/lt. as transudate, AFLDH/SLDH >0.6 as exudate and <0.6 as transudate in these calculations).

Table – 8

Tests	Cut of value	Sensitivity (%)	Specificity (%)	+ve predictive value (%)	-ve predictive value (%)	Diagnostic efficacy (%)
AFTP	2.5 gm%	38.46	80	41.66	77.77	68.75
SAAG	1.1 gm%	88.23	93.54	88.23	93.54	91.66
AFLDH	200IU/It	50	90	75	75	75
AFTP / STP	0.5	43.75	84.37	58.33	75	70.8
AFLDH / SLDH	0.6	44.4	79.5	33.3	86.1	72.9
Serum cholesterol	220 mg%	100	78.1	69.5	100	85.4

From the above table SAAG appears to be more superior than other parameters. Our finding was in correlation with that of other workers. [2-5].

V. Discussion

The incidence of ascites in nephrotic syndrome was almost equal in both sexes with slight preponderance in male children. The highest incidence of 11 cases comprising of 55% were recorded in between 3-6 yrs. It was also in correlation with the findings of age incidence mentioned in references. Ascites caused by cirrhosis of liver was more common in male children (75%). Cirrhosis was more common after 3 yrs of age (91.6%) comprising 11 out of 12 cases. From the analysis of ascites caused by tuberculous peritonitis, 5 cases out of 7 were recorded in female children comprising of 71.41%. The incidence was also more after 3 years of age comprising of 6 cases (85.7%). Out of 7 cases of ascites caused by tuberculosis, only one patient was given BCG vaccination. The rest of the patients were not given BCG.

From the analysis of incidence of SBP, 4 cases were recorded comprising of 8.33%. The incidence of SBP was more common in patients whose ascitic fluid total protein (AFTP) was less than 1 gm% comprising of 3 cases. The reason is due to decreased opsonin activity in ascitic fluid with AFTP less than 1gm%. The mean ascitic fluid total protein in SBP was 1.0. The positivity of Gram staining in SBP in our study was zero percent.

Culture was sterile in all 4 cases of SBP. This is in contrast to 40-50% positivity described in standard text books [5-8]. The reason may be 1. Prior antibiotic therapy and 2. As it is a small study no firm conclusion can be entertained. In none of the cases of tuberculous peritonitis, AFB staining of ascitic fluid was positive. Our finding of positivity of AFB was in correlation with that mentioned in standard text books [5-8]. The mean SAAG in case of portal hypertension was 2.05 with a range of 0.97 to 3.2 which is in correlation with definition of portal hypertension based on SAAG. The degree of portal hypertension as judged by appearance and grade of esophageal varices was directly related to the high SAAG. This finding was in correlation with the findings

of workers from different part of World [8]. The mean AFTP and SAAG in different causes of ascites in our study were in correlation with the findings of workers from different parts of World.

From the above analysis 18 out of 20 cases (90%) of nephrotic syndrome were having SAAG less than 1.1 gm% as against 2 cases (10%). When these findings were compared with AFTP content, 16 out of 20 cases (80%) were having AFTP less than 2.5 gm%. SAAG is more specific than applying AFTP for Nephrotic Syndrome. The reason for low gradient might be due to massive loss of protein in urine and increased catabolism. In cirrhosis of liver 12 out of 13 cases were having the SAAG of greater than 1.1 gm% and 9 out of 13 were having AFTP of less than 2.5 gm%. So, SAAG is more useful in evaluation of ascites caused by cirrhosis. In case of TB peritonitis, all 7 were having SAAG less than 1.1 gm% and 5 out of 7 were having AFTP more than 2.5 gm%. So, SAAG was more useful than AFTP in tuberculous peritonitis.

Similarly, when 18 out of 20 (90%) nephrotic syndrome cases were having SAAG < 1.1 gm%; 16 (80%) were having AFLDH < 200 IU/lt. 13 (65%) were having AFTP/STP<0.5; 16 (80%) were having AFLDH/SLDH <0.6. When 12 out of 13 (92.3%) cirrhosis cases were having SAAG > 1.1 gm%. 9(69.2%) were having AFLDH < 200 IU/lt, 11 (84.6%) were having AFTP/STP <0.5, and AFLDH/SLDH<0.6. When all 7 cases (100%) of tuberculous peritonitis were having SAAG < 1.1 gm% 6 (85.7%) were having AFLDH>200 IU/lt. and AFTP/STP>0.5. Only 3 (42.85%) were having AFLDH/SLDH>0.6.

So, SAAG was more useful than AFLDH, AFTP/STP and AFLDH/SLDH also in cases of nephrotic syndrome, cirrhosis of liver and tuberculous peritonitis. The application of these parameters (SAAG, AFTP, etc) for CCF, SBP & SLE, is not helpful because they comprised small number of cases and it was studied for a small period of time. Serum cholesterol > 220 mg/dl can separate nephrotic syndrome cases from other cases with 85.4% of accuracy. But variability of ascetic cholesterol concentration was not statistically significant among various causes of ascites. Sensitivity, specificity, positive and negative predictive values of SAAG, are all more than 88%; better than those of any other parameter.

When diagnostic accuracies of all methods are compared :-

For	SAAG	-91.66%
	AFTP	-68.75%
	AFLDH	-75%
	AFTP/STP	-70.83%
	AFLDH/SLDH	-72.91%
	Serum Cholesterol	-85.4%

So, SAAG was found to be more superior to other parameters.

The difference in accuracy is explained by the factors that influence these parameters. SAAG correlates directly with only one physiological factor – the portal pressure. In contrast, AFTP and AFLDH are influenced by their serum concentrations and portal pressure. AFTP level is directly related to serum protein concentration but is inversely related to portal pressure. In patients with cirrhosis these factors vary widely and so lead to highly variable AFTP concentrations. Among 3 cases of Cardiac ascites, all of them were having SAAG > 1.1 gm%. The elevated SAAG in patients with heart failure indicates that it is a reflection of portal pressure (which is elevated in heart failure due to high right sided heart pressure). So, SAAG classifies cardiac ascites in high gradient category along with cirrhosis ascites.

Because SAAG is proved to be superior to AFTP, AFLDH, AFTP/STP, AFLDH/SLDH, serum cholesterol and ascitic cholesterol, it should replace the total protein level as the initial factor in classifying ascites. So all ascitic fluid samples should be classified as high gradient or low gradient rather than as transudate or exudate. But AFTP has some value in specific circumstances. Patients with low AFTP are at high risk for SBP. In addition to assisting in classification of ascites, SAAG has also importance in predicting response to treatment. Ascites due to portal hypertension (eg. Cirrhosis) usually responds to dietary sodium restriction and diuretics. Ascites unrelated to portal hypertension (eg. Peritoneal TB) is refractory to diuretic therapy.

VI. Summary & Conclusions

- The incidence of ascites was more common after 3 yrs of age, particularly in between 3-6yrs.
- Nephrotic syndrome is the commonest cause of ascites in children. Other common causes are cirrhosis of liver and tuberculous peritonitis.
- The mean SAAG in portal hypertension was 2.05 with a range of 0.97 to 3.2
- The appearance and degree of esophageal varices was directly related to high gradient SAAG, in portal hypertension.
- SAAG is superior to AFTP, AFLDH, AFTP/STP, AFLDH/SLDH, serum and ascitic cholesterol in the differential diagnosis of ascites.

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