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Radiological Investigations for Predicting Severity of Dengue Infection in Children.

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Abstract:
Introduction:*Severe Dengue virus infection is a major public health problem leading to considerable morbidity and mortality especially in children .It is essential to devise methods for early detection of progress of simple dengue fever without complications to severe dengue. Radiological tools are useful in this aspect by early prediction of impeding transudation of plasma into third space, before the clinical features are apparent.*
Material and Methods: *To evaluate the radiological tools a Prospective cross sectional study was devised in a tertiary care centre.Sample size was calculated to be :80 patients- 40 of Denue fever and 40 with severe Dengue. NS1Ag, Dengue IgM, IgG test was carried out in every patient. Other investigations of complete blood count,hematocrit,Platelet count,SGPT,Prothrombin time , PTTK were done.All the patients underwent Chest radiograph, Ultrasound abdomen and chest.*
Results: *maximum number of cases were seen in September and October, Radiological evidence (Ultrasonography)showed Hepatomegaly which had :Sensitivity=87.5%,Specificity=35%,OR=3.77 and Tender Hepatomegaly: with Sensitivity=80%%,Specificity=65%,OR=7.43.P value of Pleural effusion hepatomegaly, Ascites, Gall bladder changes was also significant P<0.05).Pleural effusion was seen significantly more in severe Dengue group.*
Conclusion:*It is inferred that inclusion of radiological investigations in evaluating the course of dengue fever will help in detecting cases ofimpending shock,thereby helping in early hospitalization and management.*
Keywords: *Denguefever,Severe dengue, Pleural effusion,Ultrasonography,, X-Ray chest.*

I. Introduction

Dengue infection results from bite of female aedes aegypti mosquito, which transmits Dengue virus to susceptible host. The virus belongs to family *Flaviviridae* and its infection leads to an Acute Febrile Illness due to any of the 4 dengue virus serotypes. WHO classification includes three categories:1)Dengue Fever 2)Dengue Fever with warning signs 3)Severe Dengue. The illness is characterized by biphasic fever which may be accompanied by hemorrhagic manifestations and shock due to plasma leakage into third space.

1.1Dengue Infection follows two patterns of infection, Primary or Secondary. Patient who is infected for the first time mount a primary IgM response .This confers lifelong immunity against that re infection with same serotype. Persons who had previous exposure to flavivirus have IgG as dominant response. This IgG is not protective and subsequent infection by another serotype may result in severe dengue. It in fact increases its capacity to multiply in host monocytes ,which in turn leads to activation of cross-reactive CD4+ and CD8+ cytotoxic lymphocytes. This results in release of cytokines leading to plasma leakage and hemorrhage.

1.2 Pathophysiological changes of increased vascular permeability results in loss of plasma in third space,hemoconcentration and shock.Hemostasis impairment is due to presence of thrombocytopenia and coagulopathy.

1.3 Clinically Dengue Infection is divided into three phases-Febrile ,Critical and Recovery phase. Not all children will enter the critical phase, however for those who do,It is the recognition of onset of Critical phase which is of utmost importance .It is heralded by increase in capillary permeability leading to Polyserositis as Pleural effusion and Ascites. Hypotension has been seen to occur up to 48 hours after defervescence. This may be picked up early by sonography as effusion.before changes in hematocrit levels[1].
Besides effusion other findings detected are pericardial effusion, gallbladder wall thickening,and rarely , the presence of fluid in the perirenal space can be visualized [2,3].

The characteristics of DHF distinguishing it from DF(without warning signs or severe dengue) include increased vascular permeability ,along with marked by thrombocytopenia associated with a coagulation disorder and hepatomegaly and/or abnormal liver function. Small scattered pulmonary infiltrations or small pleural effusion were common observations in most X-ray chest of severe Dengue patients. These changes in CXR appear on or after third day of fever and are seen to be progressive during first week. Improvement during

second week are observed in those with abnormal CXRs. Significant correlation among laboratory findings, clinical course, and Radiological findings[4

II. Materials and Methods

Type of Study: Prospective cross sectional study from July2011 to September 2012.
Place of Study: Tertiary care center at semi urban area of Pimri ,Pune
Sample size:80 patients-40 of 40 of Denue fever and 40 with severe Dengue.
Institutional ethical clearance was obtained prior to starting of study.

Inclusion Criteria:

All children 1year to 12 years of age who tested positive for dengue fever, Dengue hemorrhagic fever and dengue shock syndrome.

Exclusion Criteria:

Those children who had known hematological disorder and those whose consent could not be obtained were excluded from study.

III. Methods

Patients were divided into two groups-Severe Dengue Group having shock or bleeding manifestations and Dengue fever group without any complications. Tourniquet test was done on each patient in addition to though physical examination. NS1Ag, Dengue IgM, IgG test was carried out in every patient. Other investigations of complete blood count,hematocrit,Platelet count,SGPT,Prothrombin time , PTTK were done. All the patients underwent Chest radiograph, Ultrasound abdomen and chest.

Evaluation:

Analysis was done using SPSS version 7 by applying chi square test, Odds ratio and Z test.

IV. Results

3.1Observation and Results:

4.1 Monthly Distribution of cases in study groups:-

Month/Year	Severe Dengue n=40	Dengue Fever n=40	Total N=80
July2011	0	1	1
Aug2011	1	1	2
Sep2011	2	0	2
Oct2011	1	1	2
Nov2011	1	1	2
Dec2011	0	0	0
Jan2012	3	0	3
Feb2012	0	1	1
Mar2012	2	0	2
Apr 2012	0	1	1
May2012	0	0	0
Jun2012	2	3	5
July2012	0	2	2
Aug2012	5	2	7
Sep2012	6	7	13
Oct2012	13	18	31
Nov2012	3	2	5
Dec2012	1	0	1
Total	40	40	80

Line Diagram shoeing monthly distribution of cases

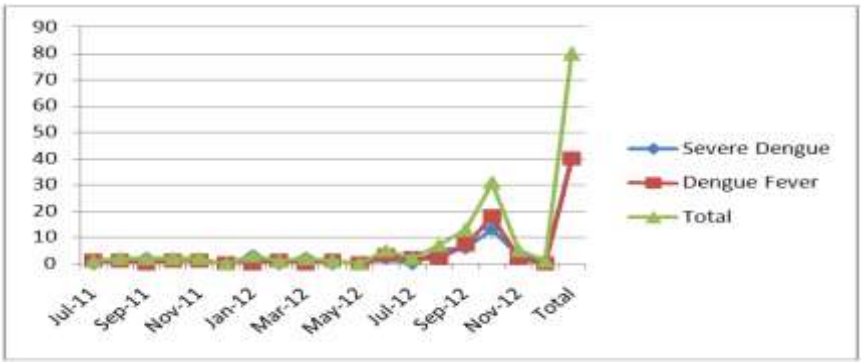


Table 4.2 Comparison of Hepatomegaly and tender hepatomegaly in study groups

Parameter	Severe Dengue n=40	Dengue Fever n=40	Z value	P value
Hepatomegaly	35(87.50)	26(65)	2.45	<0.05
Tender Hepatomegaly	32(80)	14(35)	4.57	<0.0001

Hepatomegaly:Sensitivity=87.5%,Specificity=35%,OR=3.77
Tender Hepatomegaly: Sensitivity=80%%,Specificity=65%,OR=7.43

Bar diagram showing pattern of hepatomegaly in study group

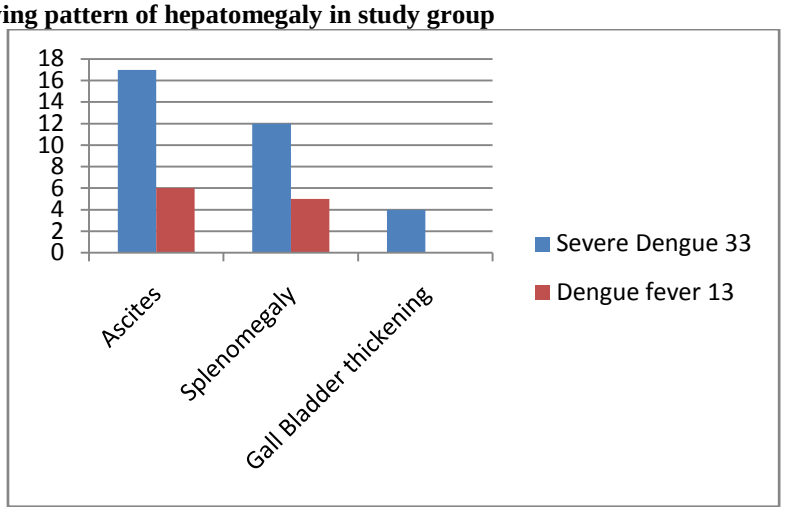


Table 4.3Ultrasonography(USG) findings in study group:

USG finding	Severe Dengue	Dengue fever	Z value	P Value
Hepatomegaly	33(82.5)	13(32.5)	5.24	<0.0001
Ascites	17(42.5)	6(15)	2.85	<0.01
Splenomegaly	12(30)	5(12.5)	1.96	<0.05
Gall Bladder thickening	4(10)	0(0)	2.11	<0.05
Cholecystitis	2(5)	1(2.5)	0.59	>0.05

Bar Diagram showing USG findings in Dengue Infection

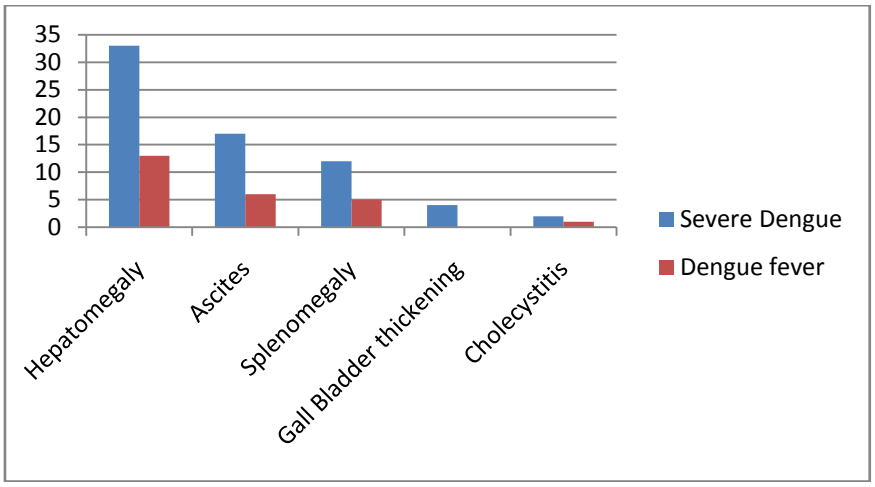
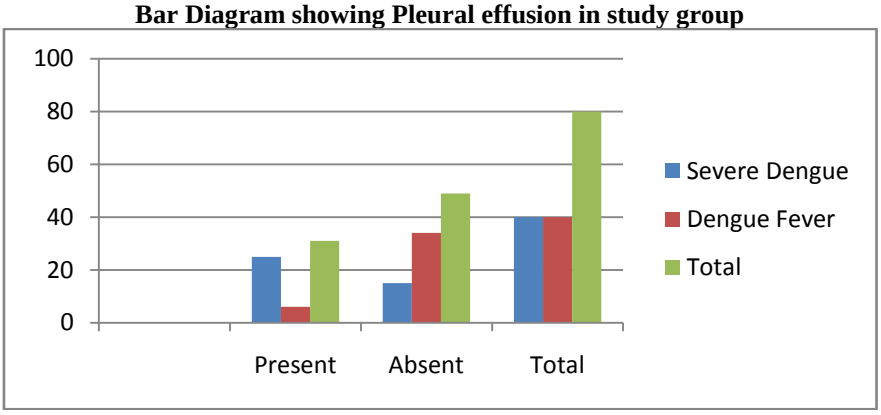


Table 4.4: Chest XRay wise distribution of cases in study group

Pleural Effusion	Severe Dengue n=40	Dengue Fever n=40	Total
Present	25	6	31
Absent	15	34	49
Total	40	40	80

P value:<0.0001 OR=9.44

Bar Diagram showing Pleural effusion in study group



IV. Discussion

Dengue fever is usually a benign infection Clinically manifesting as fever with rash at one end to massive bleeds ,Disseminated intravascular coagulation and shock at other end. These features are highly variable and do not always correlate with laboratory abnormalities[5].In our study maximum number of cases were seen in September and October. Similar peaks have been reported in SEA update[6].

In our study Pleural effusion,hepatomegaly,tender hepatomegaly ,splenomegaly were associated significantly with Severe Dengue. These signs are often prone to subjective impression. If we have to depend on these signs for any important prediction, we need objective evidence. This is brought to us by Radiological investigations.

Hepatomegaly was seen in76.5% of our patients and tender hepatomegaly in 57.5%.. The studies of Narayan M et al showed 52.5% with hepatomegaly, while in Samantha Hammond et al and Raju Chhina et al observed 22% and 12.1% hepatomegaly respectively[7,8,9].Shivbalan et al found 57% dengue patients with tender hepatomegaly[10].

Ultrasonography and X-ray chest and abdomen ,can readily detect presence of pleural fluid and Ascites. In our study these findings were significantly associated with Severe Dengue. In a study conducted at Chennai by Balasubramaniam et al,they found USG scan superior to X Ray in detecting plasma leakage.

Sonographic findings express the increase in capillary permeability (a sign of plasma leakage) in form of cavitary effusion(Ascites, pleural and pericardial effusion), and gallbladder wall thickening present in one third of patients affected by the mild presentation, and in 95% of cases with the severe presentation of DHF. Fluid in the perirenal space can also be seen[11,12].

In our study Ultrasonography picked up pleural effusion in 87.5%,ascites in 42.5%,hepatomegaly in 82.5%,Gall bladder thickening in 15% of Severe Dengue Patients.In study by S Balasubramanium et al ,pleural effusion was found in 67.6%ascites in70.7%,hepatomegaly in 86%,and Gall bladder changes in 64.6% of patients. Raju Chhina et al showed hepatomegaly in 12.1% and ascites in1.9%.Melani Setiawan et al observed Pleural effusion in 95%,Ascites in 95%,hepatomegaly in56% and gall bladder thickenning in 32% children[13].

The low sensitivity of X Rays is due to its limitation in detecting small amount of fluid,which An USG can pick up. Ultrasound scan is also better in sense of its safety and non ionizing properties.

Several studies have shown that plasma leakage occurs before defervescence

Medically most important feature of USG is that it can diagnose plasma leakage into serous (third space) before it manifests clinically[14].It is well established in the literature that, typically, the hypotension secondary to this plasma leakage occurs up to 48 hours after defervescence.The third space losses which are the fore runners of shock usually start on the third day of illness. It has been seen in studies that a lateral decubitus X-ray film is better than AP film and is comparable with USG in detecting small amount of fluid[15]. Pleural effusion is more commonly observed in DHF than in classical dengue, requiring rigorous observation[15].

In the cases of severe dengue, gallbladder wall thickening > 3.0 mm and < 5.0 mm presents a sensitivity of 93.8% and may be utilized as a criterion for patients' hospitalization and monitoring.

V. Conclusion

Ultrasonography and CXR can be considered a complementary tool to evaluate the clinical course of DHF and these examinations should be taken during the first week after the onset of illness for dengue patients.

In children with NS1 positive dengue fever, Ultrasonography and X-Ray is a relevant investigation for the early diagnosis of plasma leakage signs and for prediction of the disease severity, thereby preventing a delay in hospitalization and management and most importantly death.

References

[1]. A. Srikiatkhachorn, Krautrachue A,W Ratanaprakarn, et al, Natural history of plasma leakage in
[2]. dengue hemorrhagic fever: a serial ultrasonographic study, Pediatr Infect Dis J. 2007;26:283–90.
[3]. MW Setiawan ,TK Samsi,H Wulur , et al. Dengue haemorrhagic fever: ultrasound as an aid to predict the severity of the disease, Pediatr Radiol.1998;28:1–4.
[4]. S Thulkar ,S Sharma ,DN Srivastava et al. Sonographic findings in grade III dengue hemorrhagic
[5]. fever in adults, J Clin Ultrasound. 2000;28:34–7.
[6]. Chin-Chou Wang, Chao-Chien Wu, Jien-Wei Liu, Chest Radiographic Presentation in Patients with Dengue Hemorrhagic Fever Am. J. Trop. Med. Hyg., , 2007, 77(2), 291–296.
[7]. S Shivabalan,K Anandnathan,S Balasubramanium et al,Predictors of spontaneous bleeding in dengue,Indian J. Pediatr.2004,71(1),33-36.
[8]. Dengue update SEA 2010:situation update of dengue in SEA Region,2010.
[9]. M Narayanan,MA Arvind,N Thilothmmal,Dengue Fever Epidemic in Chennai-a Study of Clinical Profile and Outcome,Indian Pediatr,2002,39,1027-1033.
[10]. S Hammod,A Balmasda,L Perez,Differences in dengue severity in infants,children and adults in a 3 year hospital based study in Nicaragua, Am. J. Trop. Med. Hyg,2005,73(6),1063-1070.
[11]. R Chhina,O Goyal,DK Chinna,Liver function tests in patients with dengue viral infection,Dengue Bulliten-Vol32,2008,110-117.
[12]. K Jagdishkumar,P Jain,G Vaddambal,Hepatic involvement in dengue fever in children,Iranian J of Pediatrics,Vol22,2012,231-236.
[13]. W Setiawan ,TK Samsi ,H Wulur et a., Dengue haemorrhagic fever: ultrasound as an aid to predict the severity of the disease, Pediatr Radiol,1998;28:1–4.
[14]. S Thulkar ,S Sharma,DN Srivastava, et al, Sonographic findings in grade III dengue hemorrhagic fever in adults, J Clin Ultrasound. 2000;28:34–7.
[15]. W Melani, K Tarang,W Hansa,Dengue hemorrhagic fever: ultrasound as an aid to predict the severity of the disease,Pediatr Radiol,1998,28,1-4.
[16]. SA Kulratne,MM Pathirage,S Gunasena,A case series of dengue fever with altered conciousness and electroencephalogram changes in Sri Lanka,Trans R Soc Trop Med Hyg102,2008,1053-1054.
[17]. A Srikiatkhachorn,Karva et al,Natural history of plasma leakage in dengue hemorrhagic fever: a serial Ultrasonic study,Pediatric Infectious Disease Journal,26(4),2007,283-290.
[18]. MC Firmida. Derrame pleural na criança com dengue. Acta Scientiae Medica. 2008;1:35–43.