

## ORIGINAL RESEARCH

## AST to Platelet Ratio Index (APRI) and Degree of Severity based on Child-Pugh Classification among Cirrhosis Patients at Internal Medicine Ward in a Tertiary Hospital

Winanda Denis Kurniawan<sup>1</sup> , Budi Widodo<sup>2\*</sup> , Betty Agustina<sup>3</sup> 

<sup>1</sup>Medical Program, Universitas Airlangga, Surabaya, Indonesia.

<sup>2</sup>Department of Internal Medicine, Dr. Soetomo General Academic Hospital, Surabaya, Indonesia.

<sup>3</sup>Department of Clinical Pathology, Dr. Soetomo General Academic Hospital, Surabaya, Indonesia.

---

### Article Info

#### Article history:

Received Feb 18, 2022

Revised May 17, 2022

Accepted Jun 20, 2022

Published Jul 10, 2022

---

#### Keywords:

APRI

Child-Pugh

Cirrhosis

Hepatitis

---

#### \*Corresponding author

Budi Widodo

budi.widodo@fk.unair.ac.id

---

### ABSTRACT

**Background:** Simple diagnostic and screening methods are needed to assist with liver biopsy, which is not always available in local health facilities. **Objective:** To assess the AST-to-Platelet Count Index (APRI) as a means to predict the advance of cirrhosis stages as indicated in Child-Pugh classification. **Material and Method:** This research employed an observational descriptive study design to examine laboratory values such as serum AST and platelet count, which were then compared to Child-Pugh profiles among cirrhosis patients at an inpatient facility in a tertiary hospital of Dr Soetomo General Academic Hospital, Surabaya, Indonesia on 1 January – 31 December 2015. The sampling method for this research was total sampling from medical histories. **Result:** Data obtained were then analyzed and tabulated using the descriptive technique. As many as 191 samples were obtained, consisting of male (N=129, 67.54%) and female patients (N=62, 32.46%) with a ratio of 2.08:1. APRI score showed an increase in age, with a peak frequency of 68 patients (35.6%) in the range 50-59 years old. Male patients had a higher average APRI score (2.11) than their female counterparts (1.93). Patients from Child C were the majority in this research, consisting of 105 patients (54.9%), followed by Child B (N=65, 34.03%) and A (N=21, 10.9%). **Conclusion:** The proportion of patients with APRI score > 1.5 is increasing along with the degree of severity according to the Child-Pugh classification. This indicates that the rise in APRI score may predict the advance of cirrhosis stages.

---

#### How to cite:

Kurniawan, W.D., Widodo, B., Agustina, B. 2022. AST to Platelet Ratio Index (APRI) and Degree of Severity based on Child-Pugh Classification among Cirrhosis Patients at Internal Medicine Ward in a Tertiary Hospital. *Majalah Biomorfologi*, 32(2): 46-51.

*Majalah Biomorfologi (Biomorphology Journal)* p.ISSN:0215-8833, e.ISSN: 2716-0920

doi: [10.20473/mbiom.v32i2.2022.46-51](https://doi.org/10.20473/mbiom.v32i2.2022.46-51)



Copyright: © 2022 by the authors. Open access publication under the terms and condition of the Creative Commons Attribution 4.0 International license (CC.BY 4.0).

---

### BACKGROUND

From time to time, the mortality rate for cirrhosis patients increases. Research by (Mokdad, et al., 2014) shows a marked mortality increase from 1980 through 2010. In 1980, there were 676,000 deaths, or 1.54% of the global mortality rate, for which cirrhosis is accountable. Then in 2010, the rate was

raised to 1,029,042 cases or 1.94% of the global mortality rate. In Indonesia particularly, the cirrhosis death was 19.8 per 100,000 deaths, which then increased to 22.4; 24.3; 24.8; and 25.1 in subsequent decades (Mokdad, et al., 2014). A simple, cheap, and widely available instrument to detect liver fibrosis in cirrhotic patients is still in pursuit. Among the instrument that gives some prospects is AST-to-Platelet Count Ratio Index or APRI (Cheng, et al., 2020; Peleg, et al., 2017; Zhao, et al., 2019). APRI score uses simple lab-based parameters such as serum AST and platelet count to predict and detect fibrosis in cirrhosis patients. A study found that the sensitivity and specification of APRI to detect fibrosis are between 75-80% and 60-73% respectively (Oren, 2014). It is shown that serum AST, which is one of the two variables in APRI, has the potential to illustrate the degree of liver function depression (Schiff, et al., 2011; Huang, et al., 2021). Thrombocytopenia in a cirrhotic patient is also attributable to the degree of fibrosis in the liver (Anugwom, et al., 2020; Shiffman, 2011).

The Child-Pugh score is an instrument to assess the degree of severity and prognosis of chronic liver disease (Ruf, et al., 2022). The scoring system uses five variables that have been empirically proven to visualize liver function regression: ascites, encephalopathy, serum bilirubin, albumin, and prothrombin time). Child-Pugh classification is a simple and easy way to determine the severity of liver disease and assess its prognosis. One-third of patients with a score over 10 are expected to die within one year, while patients with a score of 7-9 and 5-6 have the probability of living five more years of 90% and 80%. Compared to MELD Score, a widely used cirrhosis scoring, the Child-Pugh score had a higher summary sensitivity. Furthermore, the MELD score had a higher summary specificity than Child-Pugh score in Hepatitis B-related cirrhosis (Peng, et al., 2016).

## OBJECTIVE

The purpose of the study was to observe the APRI score of cirrhosis patients in Dr. Soetomo General Academic Hospital, Surabaya, Indonesia and to see how the scores were distributed upon Child-Pugh Classification, in an attempt to elucidate a reliable way to help practising clinicians diagnose and prognosticate cirrhotic patients.

## MATERIAL AND METHOD

The study was a descriptive observational research with cross-sectional data collection to examine APRI and Child profile in cirrhosis patients undergoing treatment in a tertiary hospital of Dr. Soetomo General Academic Hospital, Surabaya, Indonesia from 1 January to 31 December 2015. This research employed secondary data obtained from medical records from the hospital's archive department. The inclusion criteria for the sample were medical records that contain lab results in question, such as serum AST, total bilirubin, albumin, PT, ascites, and hepatic encephalopathy grading. The APRI scores were calculated using the following formula:

$$\text{APRI Score} = \frac{\text{AST level (IU/L)} / \text{AST normal upper limit (IU/L)}}{\text{Platelet Count (10}^9\text{/L)}} \times 100$$

The APRI scores were then stratified according to WHO classification, which defines significant fibrosis (METAVIR  $\geq$ F2) as having APRI score  $\geq$ 1.5 and cirrhosis (METAVIR F4) to APRI score  $>$ 2. Child Classification is a clinical instrument to assess the severity and prognosis of chronic liver disease. Child Class is divided into 3 classes according to the value of albumin, bilirubin, PT, ascites, and hepatic encephalopathy. Each lab value that corresponds to a specific score is shown in Table 1, which can be calculated to yield a certain child's category.

Table 1. Child score calculation (Friedman & Keeffe 2011)

	1	2	3
Ascites	None	Controlled	Not controlled
Encephalopathy	None	Mild	Advanced
Albumin (g/dl)	>3.5	2.8-3.5	<2.8
Bilirubin (g/dl)	<2.0	2.0-3.0	>3.0
PT prolonged (sec)	≤4	4-6	>6
Child Score	5-6	7-9	10-15
Child Class	A	B	C

Data were analyzed using spreadsheet software and tabulated in the form of tables and graphs.

**RESULT**

As many as 309 medical records were listed to find those containing liver cirrhosis patients’ data. Among them, 119 were excluded because the documents missed or having incomplete laboratory data. A total of 191 medical records were then examined to assess APRI and Child Score profiles. The number of male patients were from as many as 129 (67.54%), while the other 62 (32.46%) patients were females. Most patients (35.60%) aged 50-59 years old. The average age was 51.9 years, with 22 being the youngest and 87 the oldest. APRI scores for male patients were higher in all APRI ranges. The average APRI score for males was 2.11, while the female’s average APRI score was 1.93. The majority of male patients had an APRI score in the range <1.5 (n=74, 57.36%), and the second-highest was in the range >2 (n=34, 26.36%). The same also applied to females, but with different percentages (62.9% for APRI score <1.5; and 25.82% for APRI score >2).

Child scores A, B, and C were dominated once again by male patients, with the greatest difference in Child A (n=17 vs n=4). Most patients had cirrhosis with Child C (61.9% in males, 38.09% in females). Adjusting with age and Child class, the frequency of Child B and Child C patients showed an increase from age <40 through age 50-59 years, which then fell again at age >60 years. The highest frequency was in the 50-59 years range, which had Child C cirrhosis. The distribution of APRI score and Child score were then analyzed and tabulated to yield Figure 1 as below.

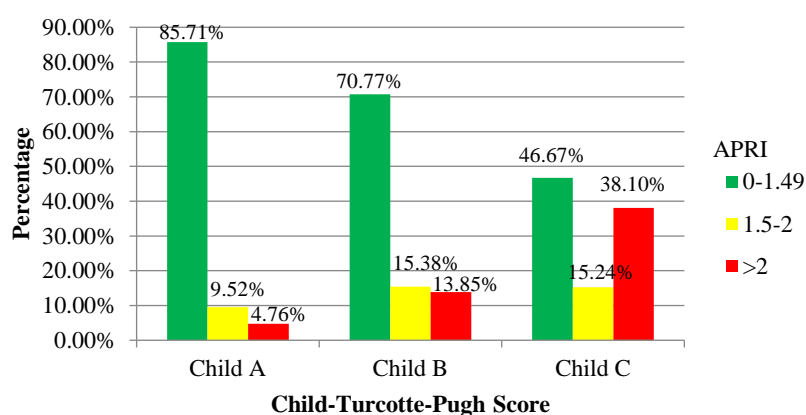


Figure 1. APRI score vs Child Score in cirrhosis patients

When adjusted for sex distribution, the APRI score and Child score profile showed a rather similar result. The frequency showed an inclination toward Child B and C at APRI score <1.5 for both males

and females. Of note, there was a sharp rise of Child C with APRI score >2 in both male and female patients.

Table 2. APRI score vs child score (sex-adjusted)

Child Class	Male			Female		
	<1.5	1.5-2	>2	<1.5	1.5-2	>2
Child A	14	2	1	4	0	0
Child B	34	8	5	12	2	4
Child C	26	11	28	23	5	12

APRI score and Child score distribution about age were shown in Table 2. It shows that the majority of Child A patients are between the ages of 40-49, while patients aged 50-59 contribute the most to Child B and C groups. All of which have an APRI score <1.5.

Table 3. APRI score vs child score (age-adjusted)

Age	Child A			Child B			Child C		
	<1.5	1.5-2	>2	<1.5	1.5-2	>2	<1.5	1.5-2	>2
<40	4	0	1	11	2	1	2	1	5
40-49	6	2	0	9	1	4	10	5	14
50-59	3	0	0	16	5	4	22	6	12
≥60	5	0	0	10	2	0	15	4	9
Total	18	2	1	46	10	9	49	16	40

## DISCUSSION

In related research by (Bao, et al., 2015), similar results were found regarding the distribution of age in cirrhosis patients. In research that involved 2.3 million cirrhosis patients, most cases were seen in patients aged 50-59 years. In addition, the group of patients aged 40-49 years made up the second-largest, which was also consistent with the findings in this study (Bao, et al., 2015). APRI scores in male patients in this study were higher than those in females. These results could be influenced by differences in serum AST and platelet counts between males and females. Females tend to have lower serum AST than males until the ninth decade when the disparity is reversed (Laouina, et al., 2012).

The role of gender on platelet count has been studied by (Biino, et al., 2013), which resulted in the finding that the number of platelets in females was significantly greater than in males (Biino et al., 2013). According to one calculation, the average difference in platelet count between males and females is  $20-40 \times 10^9/L$  (Balduini & Noris, 2014). Both of these factors may be the cause of differences in APRI scores between males and females in this study. Furthermore, APRI score differences by age are attributable to the fact that there are differences in the number of platelets at different age levels (Eicher, et al., 2018), while serum AST levels at different ages showed no particular pattern.

Child Score profile in a study showed dominance in male and elderly patients. Several theories about the high degree of severity in male patients have been proposed. One of them is the protective role of estradiol in the process of liver fibrosis due to hepatitis virus infection, thus making females more resistant to fibrosis progression (Neamatallah, et al., 2019). In addition, males intrinsically have a higher risk of Hepatitis B reactivation and developing cirrhosis and hepatocellular carcinoma (Liaw, et al., 2010).

Distribution analysis of APRI scores on Child classification indicates an increase in the proportion of patients in Child B and C on APRI scores >1.5. Previous research also provided evidence of a relationship between APRI scores and Child scores. It was noted that the average APRI score in Child A group was lower than in patients with Child B and C for both patients with and without esophageal varices (Deng, et al., 2015). Additionally, a correlation was also found in patients with decompensated cirrhosis due to hepatitis B infection, where increased APRI scores of patients will be followed by an increase in Child-Pugh score and a higher proportion of patients with decompensation (Mao, et al., 2016).

## CONCLUSION

Cirrhosis patients in the Internal Medicine ward of Dr. Soetomo General Academic Hospital, Surabaya, Indonesia showed the highest frequency in the group of patients with APRI scores <1.5 for all categories of Child Class. There was also an increase in the proportion of patients with APRI scores >1.5 with increasing degrees of severity according to the Child-Pugh classification. Thus, to some extent, we can infer that there is a tendency for APRI to correlate with the Child-Pugh Score. A further study is needed to prove the statistical significance of the finding which could help clinicians to quickly get an approximate prognosis of their cirrhotic patients and to manage accordingly. We think a simple index like APRI would give an improvement to overall patient care in cirrhosis cases.

## Acknowledgment

We thank the Medical Record Department of Dr. Soetomo General Academic Hospital for their assistance in the collection of medical records. We thank the Internal Medicine Department of Dr. Soetomo General Academic Hospital for providing the needed research environment to make this research possible.

## Conflict of Interest

All authors have no conflict of interest.

## Ethics Consideration

This research was ethically cleared and approved by Ethical Committee for Health Research of Dr. Soetomo General Academic Hospital certificate no. 472/Panke.KKE/VI/2016.

## Funding Disclosure

This research was self funded.

## Author Contribution

All authors have contributed to all process in this research, including preparation, data gathering and analysis, drafting and approval for publication of this manuscript.

## REFERENCES

- Anugwom, C. Ashraf, A. Debes, J.D., 2020. Virus-mediated thrombocytopenia in hepatitis C infection: The impact on fibrosis scores. *Digestive and Liver Disease*, 52(7): 797-798. doi:10.1016/j.dld.2020.04.027.
- Balduini, C.L. & Noris, P., 2014. Platelet count and aging. *Haematologica*, 99(6). doi: 10.3324/haematol.2014.106260.
- Bao, X.Y., Xu, B., Fang, K., Li, Y., Hu, YH., Yu, GP., 2015. Changing trends of hospitalisation of liver cirrhosis in Beijing, China. *BMJ Open Gastroenterology*, 2(1), p. e000051. doi: 10.1136/bmjgast-2015-000051.
- Biino, G. Santimone, I. Mineli, C. Sorice, R. Frongia, B. Traglia, M. 2013. Age and sex-related variations in platelet count in Italy: A proposal of reference ranges based on 40987 subjects' data. *PLoS ONE*, 8(1): e54289. doi: 10.1371/journal.pone.0054289.

- Cheng, C.H. Chu, C.Y. Chen, H.L. Lin, I.T. Wu, C.H. Lee, Y.K. et al., 2020. Subgroup analysis of the predictive ability of aspartate aminotransferase to platelet ratio index (APRI) and fibrosis-4 (FIB-4) for assessing hepatic fibrosis among patients with chronic hepatitis C. *Journal of Microbiology, Immunology and Infection*, 53(4): 542-549. doi: 10.1016/j.jmii.2019.09.002.
- Deng, H. Qi, X. Peng, Y. Li, J. Li, H. Zhang, Y. et al., 2015. Diagnostic accuracy of APRI, AAR, FIB-4, FI, and king scores for diagnosis of esophageal varices in liver cirrhosis: a retrospective study. *Medical Science Monitor*, 21: 3961–3977. doi: 10.12659/msm.895005.
- Eicher, J.D. Lettre, G. Johnson, A.D., 2018. The genetics of platelet count and volume in humans. *Platelets*, 29(2): 125–130. doi: 10.1080/09537104.2017.1317732.
- Huang, C. Sieh, J.J. Tan, C.K. Kam, J.W. Tan, J. Teo, E.K. et al., 2021. Modified AST to platelet ratio index improves APRI and better predicts advanced fibrosis and liver cirrhosis in patients with non-alcoholic fatty liver disease. *Clinics and Research in Hepatology and Gastroenterology*, 45(4). doi:10.1016/j.clinre.2020.08.006.
- Laouina, A. Abouyoub, A. Soulaymani, A. Alami, R., 2012. Alanine transaminase level in a healthy population in Morocco. *Pakistan Journal of Biological Sciences*, 15(5): 238–43. doi: 10.3923/pjbs.2012.238.243.
- Liaw, Y.F. Brunetto, M.R. Hadziyannis, S., 2010. The natural history of chronic HBV infection and geographical differences. *Antiviral Therapy*, 15(Suppl 3): 25–33. doi: 10.3851/IMP1621.
- Mao, W. Sun, Q. Fan, J. Lin, S. Ye, B., 2016. AST to platelet ratio index predicts mortality in hospitalized patients with hepatitis B-related decompensated cirrhosis. *Medicine (Baltimore) Journal*, 95(9): e2946. doi: 10.1097/MD.0000000000002946.
- Mokdad, A.A. Lopez, A.D. Shahrzaz, S. Lozano, R. Mokdad, A.H. Stanaway, J. et al., 2014. Liver cirrhosis mortality in 187 countries between 1980 and 2010: A systematic analysis. *BMC Med*, 12(145). doi: 10.1186/s12916-014-0145-y.
- Neamatallah, T. Abdel-Naim, A.B. Eid, B.G. Hasan, A., 2019. 2-Methoxyestradiol attenuates liver fibrosis in mice: Implications for M2 macrophages. *Naunyn-Schmiedeberg's Archives of Pharmacology*, 392(3): 381–391. doi: 10.1007/s00210-018-1577-2.
- Oren, T., 2014. *Liver metabolism and fatty liver disease*. 1st Editio. Boca Raton: CRC Press. doi: 10.1201/b17315.
- Peleg, N. Issachar A. Sneh-Arbib, O. Shlomai, A., 2017. AST to platelet ratio index and fibrosis 4 calculator scores for non-invasive assessment of hepatic fibrosis in patients with non-alcoholic fatty liver disease. *Digestive and Liver Disease*, 49(10): 1133-1138. doi: 10.1016/j.dld.2017.05.002.
- Peng, Y., Qi, X., Guo, X. 2016. Child-pugh versus MELD Score for the assessment of prognosis in liver cirrhosis: A systematic review and meta-analysis of observational studies. *Medicine (Baltimore) Journal*, 95(8): e2877. doi: 10.1097/MD.0000000000002877.
- Ruf, A. Dirchwolf, M. Freeman, R.B., 2022. From child-pugh to meld score and beyond: Taking a walk down memory lane. *Annals of Hepatology*, 27(1). doi: 10.1016/j.aohep.2021.100535.
- Schiff, E.R. Maddrey, W.C. Sorrell, M. F., 2011. *Schiff's diseases of the liver* in. John Wiley & Sons. Available at: [https://books.google.co.id/books?id=HsxFSx\\_B4sUC](https://books.google.co.id/books?id=HsxFSx_B4sUC).
- Shiffman, M.L. (ed.), 2011. *Chronic hepatitis C virus: Advances in treatment, promise for the future*. New York: Springer New York.
- Zhao, Y. Thurairajah, P.H. Kumar, R. Tan, J. Teo, E.K. Hsiang, J.C., 2019. Novel non-invasive score to predict cirrhosis in the era of hepatitis C elimination: A population study of ex-substance users in Singapore. *Hepatobiliary & Pancreatic Diseases International*, 18(2): 143-148. doi: 10.1016/j.hbpd.2018.12.002.