



Short-term occupational hazard exposure at tire mechanic workshops can aggravate hepatic cirrhosis? A case report.

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Article details:

Published: 30th January 2021



Abstract

Background: Hepatocellular carcinoma (HCC) is malignancy of liver that usually occurs in patient with chronic liver disease and cirrhosis. In Indonesia, HBV was an endemic disease making about 60% of of HCC was related to HBV, on the other hand 20% was related to HCV. Hazard exposure in the workplaces may play roles to initiate the HCC. One of industries have higher risk of HCC is workers at mechanical workshop. Many mechanical workshop in Indonesia including small scale industry whom didn not implementation occupational health services.

Case presentation: Man, 31 years olds came with abdominal pain, and his belly became bigger in the last 2 weeks. These symptoms start gradually with mild pain that became heavier day after day, other symptoms are constipation, nausea, vomiting, chills, difficulty to breath, and his urine became darker. His relatives also realize that the patient skin became icteric. This patient did not have a history of liver disease or have diabetes and obesity. Based on examination: icteric eyes and skin, Rubber Cement, Work Related Diseases, Return to work.

ascites, and hepato-splenomegaly. His bilirubin levels were 3.07 mg/dl for total, 2.29 mg/dl for direct, and 0,78 mg/dl for indirect. Based on imaging studies, USG has shown a mass on the right lobe of the liver, and, based on CT-scan, there was nodes on segments 6 and 7 on the liver. He recently works as tire repairs mechanic for 2 months, previously as a worker in the glass industry for 8 years of service. After a thorough analysis of his job, there were no risk factors as labor in the glass industry, but as a tire **mechanic**, he became exposed to lead that used in car/motor components and toluene from the rubber cement he used

Conclusion: The exposure of toluene through rubber cement may be related to aggravating his liver condition, and tough may be the main causes of his HCC was related to alcohol consumption. The management for return to work for this patient is quite difficult since his health prognosis is poor, making him is unfit for his current task. However, maybe after taking medication, therapy, and change of lifestyle, his condition may be better than right now to do some job that only requires light physical activities.

Keywords: Hepatocellular Carcinoma, Tire Repairs Mechanic,

To cite this article :

Ilyas, Muhammad, Arnold Fernando, Dewi S. Soemarko, M. I. M. (2021). Short-term occupational hazard exposure at tire mechanic workshops can aggravate hepatic cirrhosis? A case report. *International Journal of Health, Education and Social (IJHES)*, 4(1), 22–31.



INTRODUCTION

Hepatocellular carcinoma (HCC) is a malignancy of the liver that usually occurs in a patient with chronic liver disease and cirrhosis. However, about 25% of patients do not have a history of cirrhosis or risk factors before.¹ The incidence of HCC has been rising over the last 20 years. Asia and Africa were the highest incidence worldwide, because the high prevalence of hepatitis B and hepatitis C can occur chronic liver disease that can develop into HCC.²⁻⁴ Though in worldwide cirrhosis are the major risk of HCC, in Asia 60% of HCC was associated with HBV and about 20% is related to HCV.⁵

Small scale industries, such as tire repairs workshops in Indonesia, usually did not have a concern the occupational health services. Tire repairs workshop usually only offers a service to repairs the tires, only a few shops also offer oil replacement or machine repairment. The workplace exposure may vary depending on the workshop location, demand, and services that the shop offers. However, every tire repair mechanic was exposed to rubber cement as the main material to repair the tire. Rubber cement ingredients may vary depending on what brands and type, but most of them have toluene, latex, acetone, heptane, hexane, ethanol, and isopropanol to be risk factor to HCC. Many informal mechanics also did not realize that many materials and products that expose them could have several health risks, such as lead exposure. Due to a lack of awareness about their exposure, workers usually eat, smoke, or drink while at work, and such workplace practices may aggravate their exposure.⁶

Although multiple factors can cause HCC and cirrhosis hepatitis, analysis of hazard potential in workplaces must be performed to confirm the health condition are occupational disease, work-related disease, or not. The Seven Steps of Occupational Diagnosis, a method issued by Indonesian Occupational Medicine Association-IOMA, was conducted to confirm the relation between HCC, cirrhosis hepatitis, and workplace hazards. Then, consider the patient's condition, fit or not back to work, and adjust to maximize his condition.

CASE PRESENTATION

A thirty-one-year-old male patient came to the emergency room with abdominal pain as his chief complaint, this pain has been felt since two weeks ago, but it starts with very mild pain making the patient ignore it. The patient also complains his belly becomes bigger since that. After one week, he ignored the symptoms, the pain becomes moderate, and his belly becomes



bigger than before. The patient also complained that he is constipated recently (defecated once in two or three days), with hard consistency. The colors became yellow-brownish. Other symptoms are nausea and vomiting about once or twice daily (usually after eat), chills, difficulty breathing, and his urination frequency became less, and the colors seem like a tea. However, he denied that he felt pain or hot during urination. This patient has been seeking medical treatment through his relation, which is a nurse, and given some drugs to reduce the pain and launch the bowel movements, but his condition still not getting better. One day before hospitalized, his abdominal pain became severe (VAS 9-10), making it difficult to do basic daily activity. He was not defecated since four days ago, feeling breathless. His family members also think that his skin became icteric.

This patient was worked as a laborer in a glass factory for 8 years and stopped working there about 2 months before hospitalized because the factory became bankrupt. He started to making a tire repair workshop to earn for living. After hazard identification on his workplace in a glass factory and his tire repairs workshop and analyze it by the seven steps of occupational diagnosis, there is no hazard potential in his previous work that can trigger cirrhosis, hepatitis, and HCC. Nevertheless, there is a potential hazard in his workshop that may impact his liver condition. Most of the tire mechanics lack knowledge about the things that mechanics handled can be exposed by lead through material and products. Lead exposure can severely affect his liver function. Toluene on rubber cement that he uses to repair the tire can damage the liver, especially to the one who abuses the solvent. After a thorough analysis of the seven steps, it is concluded that his HCC condition is related to work, but the main causes are still unclear. However, it seems caused by his behavior to drink alcohol one bottle per week that may induce hepatic cirrhosis. Occupational management for this patient is still needed to maximize his potential after discharged from the hospital.

DISCUSSIONS

Finding evidence for this case has been conducted by reviewing an article that has been collected using the 1 keywords (mechanic*) AND ((hepatoma) OR (hcc)). 2 keywords ((hepatoma) OR (hcc)) AND ((occupation) OR (work exposure)), both of them are using MeSH terms searched through PubMed and keywords for google scholar are mechanic* occupation* "hcc". The inclusion criteria included human studies, using adult subjects, and



relevant with this case. Exclusion criteria included case report articles, pathophysiological, opinion papers, and articles besides English and Indonesian.

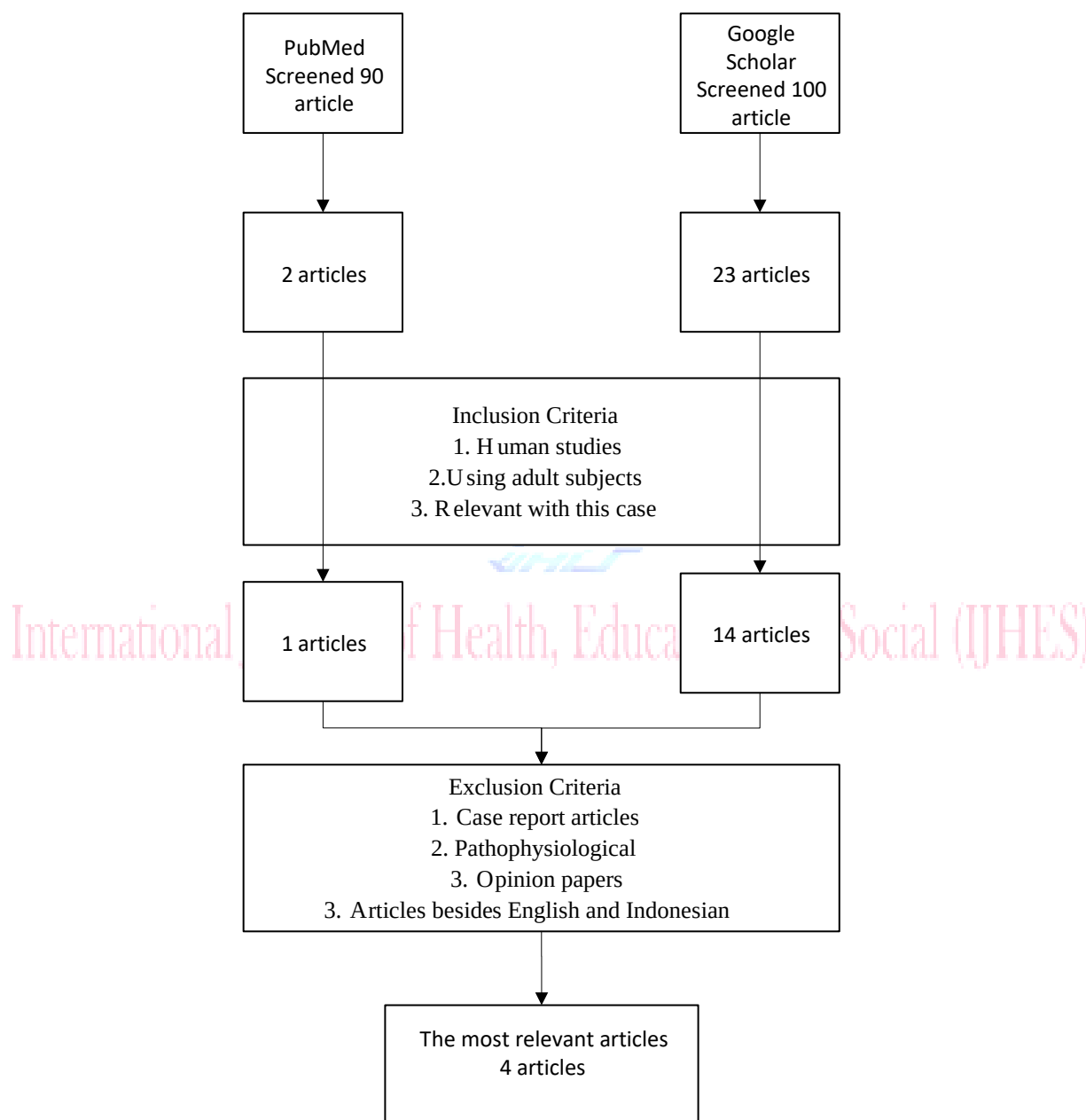


Figure 1. The process of article selection



Using these criteria, the article was shortlisted, and eventually, four articles are the most relevant with a clinical question. All of them are cross-sectional studies on vehicle mechanics as a subject. None of the articles that have been shortlisted focused on hepatocellular carcinoma on vehicle mechanics, and then the most relevant study focuses on the liver function test results on vehicle mechanics. All four cross sectional articles appraised using appraisal tools by CEBM as presented in tables no 1, 2, 3, and 4. ⁷

Adejumo et, al conducted an observational study to compared the differences in liver function test results between automobile professionals and adult living males in the same city but not exposed or have a low risk to exposure by automobile workshops pollutants. The study results are there were no significant differences between the case and control groups except for γ – glutamyl transferase activity ($P < 0.05$). The study then concluded there an unimpaired liver function in automobile workers results of γ – glutamyl transferase may be suggestive there is lead-induced toxicity at the autoworkers. ⁸

The second article, Ataro et al. assesses garage workers' biochemical levels that may relate to their health condition. They compare the biochemical test results among 30 garage workers and 30 people of the control group consisted of teachers and students. The results are that the mean serum level of liver function test in garage workers significantly increases than the control group. Alanine aminotransferase (35.60 ± 7.93 vs 19.17 ± 0.91 U/L; P -value = 0.04), aspartate aminotransferase (47.23 ± 4.89 vs 27.03 ± 1.13 U/L; P -value = 0.0002), total protein (85.83 ± 1.16 vs 76.40 ± 0.86 g/l; P -value < 0.001).⁹

Khan et al. assess the effect of automobile workshop environment on auto mechanics health in N. W. F. P. Pakistan using biochemical analysis. Fifty automobile workers were randomly selected, and ten university students were not exposed to the automobile workshop environment selected as a comparison. Based on characteristics, all of the workers have belonged to lower-class status, and 36% of them were narcotics users (snuff, cigarettes, hashish, etc.) may bias the results. The workers SGPT (104.4 ± 49.46 IU/L), calcium (18.96 ± 0.04877 mg/dl), bilirubin direct (0.877 ± 0.206 mg/dl) and bilirubin indirect (0.986 ± 0.324 mg/dl) were higher than the control group makes the author have a conclusion that automobile workshop environment has a significant ill effect on liver function, but further studies with larger population need to be conducted to confirm that.¹⁰



Owino et al. assessed blood lead levels and associated health risks on estimated glomerular filtration rate (eGFR) and serum Alanine Aminotransferase (ALT) activity among the study participants. This descriptive study compares the glomerular filtration rate (eGFR) and serum Alanine Aminotransferase (ALT) activity of automobile repair artisans and non-exposed medical college students. The blood lead levels were analyzed using NIOSH 8003 method and biochemical analysis measured with Reflotron automated biochemical analyzer. The mean blood lead (Pb) level of the subjects group was significantly higher ($25.36\mu\text{g/dl} \pm 2.62\text{SE}$) than the control ($14.17\mu\text{g/dl} \pm 1.74\text{SE}$). ($t(29) = 3.65$, $p = 0.001$). Moreover, it exceeded the $20\mu\text{g/dl}$ WHO biological exposure index (BEI) of concern for adults. ($p = 0.049$). The eGFR of cases group was significant decreased ($128.37 \text{ mL/min/1.73m}^2 \pm 4.37\text{SE}$) than control ($152.93 \text{ mL/min/1.73m}^2 \pm 3.91\text{SE}$), ($t(29) = -4.49$, $p = 0.000$), but on the other hand the ALT results ($18.50 \text{ IU/L} \pm 1.63\text{SE}$) was lower at cases group compared to the control ($21.34 \text{ IU/L} \pm 2.85\text{SE}$), even though it was not significant ($t(29) = 0.86$, $p = 0.40$).¹¹ The author concluded that the automobile Repair Artisans were exposed to lead and have a risk of chronic effects on kidney and liver.

Based on these four articles, two of them have an insignificant difference in liver function between the case and control groups. Even though another two study has a significant difference between the groups, but it seems that these two study still have many confounding factors and selection bias, the control groups' results seem better than the cases group.

In the Adejumo et al., the two groups' size sample is different (89 vs. 50), but they have matched aged and live in the same city. It is still unclear that they have a similar social-economy status or not, then there is no info about dietary, drug consumption, and whether there are any comorbidities like diabetes. However, the author excluded if subjects have a history of liver disease, alcoholism, hypertension, and cardiovascular disease. This study evaluated liver function through biochemical analysis of total bilirubin (TB), conjugated bilirubin (CB), albumin (ALB), total protein (TP), alkaline phosphatase (ALP), aspartate aminotransferase (AST), alanine aminotransferase (ALT), and gamma-glutamyl transferase levels.⁸

Ataro et al. comparing between 30 garage workers and 30 (teacher/students). This study aim is to estimate the differences in the two groups' biochemical levels. The method of selecting the subjects is clearly described. The sample size was calculated based on two similar studies that have been conducted in Nigeria chosen randomly to represented garage workers. The



socio-economy status may have a role in influencing the different biochemical results of these two groups, but based on the similarity of job desk and mean age of our patient give the impression exposure at the auto mechanic workshop may influence liver function.⁹

Khan et al. focused on the risk exposure of polycyclic aromatic hydrocarbons (PAH) and lead (Pb) on auto mechanics, even though they did not measure the work environment's exposure and do biomonitoring. They assess the effect of the exposure by measuring the serum glutamate pyruvate transaminase (SGPT), uric acid, calcium, bilirubin, and hemoglobin levels also conducted screening for HBV and HCV to ensure that the biochemical results were not influenced by viral infection hepatitis. The author does not mention the method of subject selection clearly, and there is no information about why the size of the case group sample was 50, and the control group sample was only 10. They also differ in social, economic status, and habits. Also, about 36% of subjects are narcotic users. It is still unclear that the sample of subjects could be representatives of the population because irrespective of their age and working hours, but it can be a pitfall if most of the selected subjects would not be representative to the population (most of them are old or young, or have several conditions).¹⁰ This study gives the impression that auto-mechanics have a significant risk of elevating liver function tests that may aggravate his liver condition.

Owino et al. also focused on the lead exposure on informal automobile repair artisans. In this study, they also measure the blood lead levels using NIOSH 8003 method. They also measure biochemical analyses such as creatinine levels and ALT serum levels on blood. The creatinine results then converted into estimated glomerular filtration rates (eGFR) using the eGFR calculator based on the Modification of Diet in Renal Disease Study (MDRD) equation, which has been recommended by the USA National Kidney Foundation. This study also specifies the job task of automobile artisan to interpret which one is the highest risk. The authors also mention the method that they used to select the subject. However, it seems that they still have a selection bias because of the differences in social-economy status, habits, and control group. The author has mentioned that they are free of a history of chronic illness, but how about the case group if it is not excluded like the control group, even if there were significant differences, the history of chronic illness plays the role.

Discussions

Based on a study from the University of Michigan, it is known that the relation between HCC and alcohol consumption is dose-dependent. The risk increased after consuming alcohol more



than 1500 grams per year on the other hand.¹² There is no safe limit to consume alcohol, and even after cessation, the risk to occurs HCC will only fall by 6-7 % a year.^{13,14}

Lead exposure on the workshops may also play a role to aggravated this patient's condition, but not as an etiology of the diagnosis. Toluene also cannot be the causes of cirrhosis hepatitis for this short-term exposure, the exposure of toluene through rubber cement may aggravate his asymptomatic cirrhosis, make the occurrence of decompensation like ascites, though it is unclear does the HCC already develop before the exposure of toluene in an asymptomatic state or after the exposure of toluene.¹⁵

After knowing that lead and toluene can aggravate his condition and his health condition are still poor, it seems that this patient is unfit as a tire repairs mechanic because the exposure to lead and toluene will aggravate his hepatic cirrhosis. Besides that, HCC has a poor prognosis if not treated properly, making this patient avoid modifiable risk to ensure his condition is not worsening. This patient may work on another task that would only require light physical activity and no hazard potential that can aggravate his liver condition.

After analyzing this patient through seven steps of occupational diagnosis, it can be concluded that the exposure of toluene can aggravate his liver disease but not the one who causes this patient have HCC, that is why this patient is not fit for this job position because the main materials to repairs tires are using the rubber cement which contains toluene which can be worsening his liver condition. The prognosis of HCC is poor making proper medication and therapy are needed to improve the quality of life and survival rate of this patient. However, after his condition became stable, they may do other kinds of jobs that only required light physical activities and no potential hazard that may aggravate his liver problems.

Acknowledgment

This case report was conducted in Fatmawati Central Hospital, authors would say thank you for all medic staff and paramedic staff at internal medicine ward help us complete this case report.



REFERENCES

1. Petrick JL, Kelly SP, Altekruse SF, McGlynn KA, Rosenberg PS. Future of hepatocellular carcinoma incidence in the United States forecast through 2030. *J Clin Oncol*. 2016;34(15):1787.
2. Lozano R, Naghavi M, Foreman K, Lim S, Shibuya K, Aboyans V, et al. Global and regional mortality from 235 causes of death for 20 age groups in 1990 and 2010: a systematic analysis for the Global Burden of Disease Study 2010. *The lancet*. 2012;380(9859):2095–128.
3. Doe JE, Paddle GM. The evaluation of carcinogenic risk to humans: occupational exposures in the spraying and application of insecticides. *Regul Toxicol Pharmacol*. 1994;19(3):297–308.
4. Chen C-J, Iloeje UH, Yang H-I. Long-term outcomes in hepatitis B: the REVEAL-HBV study. *Clin Liver Dis*. 2007;11(4):797–816.
5. Omata M, Cheng A-L, Kokudo N, Kudo M, Lee JM, Jia J, et al. Asia–Pacific clinical practice guidelines on the management of hepatocellular carcinoma: a 2017 update. *Hepatology*. 2017;66(2):383–96.
6. Adela Y, Ambelu A, Tessema DA. Occupational lead exposure among automotive garage workers—a case study for Jimma town, Ethiopia. *J Occup Med Toxicol*. 2012;7(1):1–8.
7. What is Critical Appraisal? – Center for Evidence Based Management [Internet]. [cited 2021 Jan 23]. Available from: <https://cebma.org/resources-and-tools/what-is-critical-appraisal/>
8. Oke OM, Ikenazor HO, Oluwole MM. ASSESSMENT OF LIVER FUNCTION OF SELECTED AUTOMOBILE PROFESSIONALS IN SOUTH-SOUTH REGION OF NIGERIA.
9. Ataro Z, Geremew A, Urgessa F. Chemical exposure in garage workers and related health risks on the biochemical levels: A comparative study in Harar town, eastern Ethiopia. *SAGE Open Med*. 2019;7:2050312119846792.
10. Khan AA, Inam S, Idrees M, Dad A, Gul K, Akbar H. Effect of automobile workshop on the health status of automechanics in NWFP, Pakistan. *Afr J Environ Sci Technol*. 2010;4(4):192–200.
11. Owino OA, Moturi WN, Obonyo M. Health Effects of Occupational Lead Exposures among Informal Automobile Repair Artisans: A Case Study of Nakuru Town, Kenya. *Int J Toxicol*. 2019;4(2):079–88.
12. Marrero JA, Fontana RJ, Fu S, Conjeevaram HS, Su GL, Lok AS. Alcohol, tobacco and obesity are synergistic risk factors for hepatocellular carcinoma. *J Hepatol*. 2005;42(2):218–24.
13. Shimazu T, Sasazuki S, Wakai K, Tamakoshi A, Tsuji I, Sugawara Y, et al. Alcohol drinking and primary liver cancer: a pooled analysis of four Japanese cohort studies. *Int J Cancer*. 2012;130(11):2645–53.



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Social (IJHES)**

14. Heckley GA, Jarl J, Asamoah BO, Ulf G. How the risk of liver cancer changes after alcohol cessation: a review and meta-analysis of the current literature. BMC Cancer. 2011;11(1):446.
15. Heidelbaugh JJ, Bruderly M. Cirrhosis and chronic liver failure: part I. Diagnosis and evaluation. Am Fam Physician. 2006;74(5):756–62.



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