ปัจจัยเสี่ยงของการติดเชื้อไวรัสตับอักเสบ ซี ในผู้ใหญ่ จังหวัดเพชรบูรณ์ ปี พ.ศ. 2549

(Risk factors of viral Hepatitis C infection among adults in a northern province, Thailand, 2006)

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Abstract

Background: Since 1998, viral hepatitis C (HCV) infection has been a disease under notification in Thailand (Non A-B since 1982). By the end of 2006, the number of cases reported during the previous three years had doubled (number/year: 270/2003, 396/2004, 407/2005, 734/2006). Majority of cases were diagnosed in Petchabun Province (26.7%). The Bureau of Epidemiology and local health authorities started outbreak investigations in the province aimed at identifying the risk of infection and implementing control measures.

Methods: We reviewed HCV reports in the provincial health office and hospital records. Duplicated reports were deleted. A case-control study was conducted using a structured questionnaire. Case was defined as a resident aged 20-60 years and staying in Muang, Lomsak or Lomkao Districts in Petchabun Province during 2006, with laboratory confirmed HCV by RNA detection or ELISA on repeat testing. Controls were randomly selected residents, matched by village, with laboratory confirmed negative for HCV RNA by PCR and antibody by ELISA technique.

Results: There were 13, 34 and 36 cases per year in Phetchabun during 2003-2005. Total 45 and 43 met case and control definitions respectively. Among 45 cases, 87% were males and 57% were injection drug users (IDU). Cases were mostly (70%) asymptomatic. Two cases were found to be ELISA negative, but RNA positive. Univariate risk factors included being IDU, male gender, history of shaving by barber and using commercial sex services. Multiple logistic regression revealed that only IDU was associated with HCV infection, with adjusted OR = 12.9 (95% CI = 2.2-75.2). Factors that had dose-response relationship with HCV infection included shaving by barber ($p<0.01$), irregular condom use ($p<0.01$) and tattooing ($p=0.02$).

Conclusion: Petchabun Province could be considered as an endemic area for HCV. IDU was the major risk factor for HCV infection in adults. Discordant laboratory results of two cases suggested the need to review the blood screening protocol. The blood bank was informed for the finding. Further study to determine the effects of interferon and antiviral, especially for the treatment of genotype 6 would be benefit to the patients.

Keyword: HCV outbreak, HCV genotype, risk factors, Thailand

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Introduction

Viral hepatitis C infection is an insidiously progressive hepatic inflammation and necrosis disease. Fifty to seventy percents of chronic hepatitis C cases will be exacerbated by acute hepatitis [1]. The chronic hepatitis C is asymptomatic, but the patient will develop cirrhosis by 20% and hepatocellular carcinoma (HCC) by 1-4% per year as the consequences [2]. Hepatitis C virus (HCV) is a positive single-stranded RNA with enveloped and icosahedral capsid. There are 6 major genotypes (genotype 1 to 6) [1]. Each genotype is found in specific country and varies in medical treatment [1]. Major routes of transmission include receiving blood products before 1992, repeated hemodialysis and intravenous drug injection [3]. Other risks are skin piercing/tattooing with non-sterile needles and equipments, sexual contact without protection and mother-to-child transmission [3,4].

The World Health Organization (WHO) estimated 170 millions of HCV carriers globally. The prevalence in USA and Western Europe were 4 and 5 millions of HCV carriers respectively [2]. The WHO/South-East Asian Region estimated 25 millions of HCV carriers in the region and 2.9% (5-5.6%) for Thailand [5].

There were 3 categories of hepatitis, including hepatitis A, hepatitis B and non-A non-B hepatitis, for the disease under notification in Thailand since 1982. After 1998, hepatitis C, D, E were added into the reporting system. The number of hepatitis C reported in Thailand had been gradually increased since 2004. By the end of 2006, the number of case was doubled, with majority of cases reported in Phetchabun Province (26.7%). The unexpected high number of cases alerted the Bureau of Epidemiology, the 9th office for diseases control region and the local health authorities to start investigation, aiming to identify risk factors of infection and implement control measures.

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Methods

Recruitment of cases and control

1. The reported hepatitis C cases were reviewed and deleted the duplicated cases. The medical records from hospital were also reviewed to identify the patients who met the case definition. The case definition was defined as a person aged 20-60 years who had laboratory confirmation of HCV either by ELISA or PCR and living in Lomsak, Lomkao or Muang Districts in Phetchabun Province during 2006.

2. The health centers, with a case reported before, were asked to prepare the family folders of households in catchment areas for sampling of controls. A family folder was randomly selected and family members were reviewed to be enrolled as a control. A family member aged most close to the case was asked to collect blood for hepatitis C testing. If that person refused, the next family member was asked to be enrolled. If the sampled family had no member to be enrolled, the nearby family was selected to be tested.

3. A control was defined as a person who aged 20-60 years old and lived in the same village of the case and laboratory PCR and ELISA tested negative for hepatitis C.

4. If a person who was enrolled as a potential control was tested positive either by PCR or ELISA, then that person was classified as a case (Figure 2).

Laboratory Investigation

After obtaining oral consent from cases and controls, blood sample was drawn for 10 ml. The blood sample was centrifuged to separate the serum. The serum was kept below 4 degree Celsius during transportation. The specimens were sent to test for Hepatitis B Virus (HBV) and HCV infection at the Center of Excellence in Clinical Virology, Department of Pediatrics, Faculty of Medicine, Chulalongkorn University and Hospital, Bangkok.

The laboratory investigation included HCV RNA and HBV DNA detection by Reverse Transcriptase-Polymerase Chain Reaction (RT-PCR) from serum. HCV antibody and HBsAg were evaluated by ELISA technique. Details of HBV DNA, HCV RNA detection and genotyping methods were reported elsewhere [6]. Molecular epidemiological study on HBV in Thailand was based on analysis of pre-S and S genes [7]. In order to manage the discordant of laboratory results, we collected a new specimen and repeated the whole process of the laboratory testing.

Analytic Study

A structural four pages questionnaire was developed to interview the cases and potential controls. The questionnaire consisted of demographic data, clinical status and behavioral risks, including reasons for HCV testing. Case-Control ratio was 1:1, without matching for either age or gender.

Statistical Analysis

Univariate analysis was performed by Epi Info version 3.3.2 (CDC, Atlanta, USA). Chi-square for trend was evaluated by dose-response analysis. Multivariate analysis was conducted by including well known risk factors and significant risk factors into final model of analysis.

Results

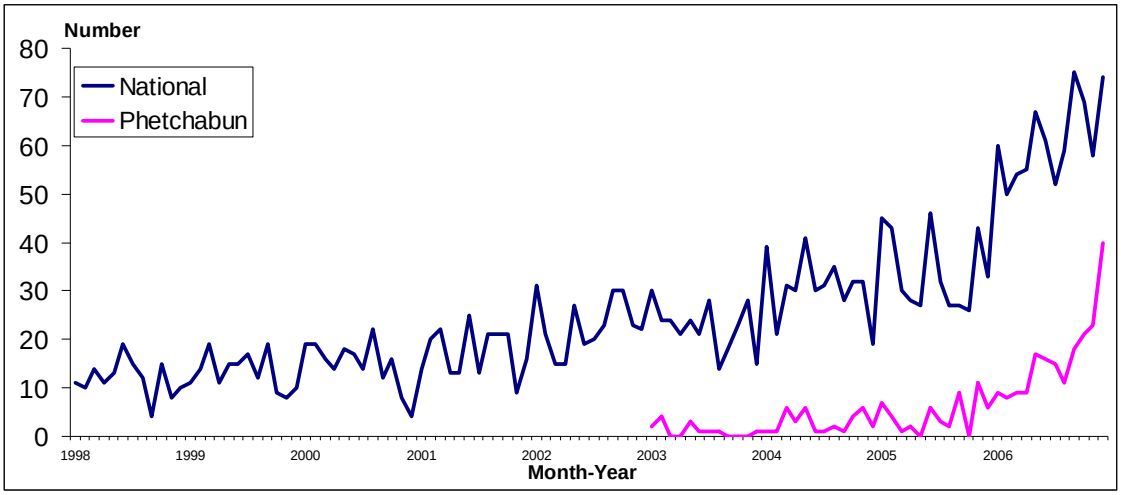
Descriptive Results

There were 196 HCV reports from Phetchabun Province to the national surveillance system in 2006. Among these, 60 cases were duplicated reports in 2006 and 10 cases were duplication of the previous years. Districts with the highest number of reports were Muang (62/126, 49.2%), Lomsak (45/126, 35.7%) and Lomkoa (17/126, 13.6%). Among these, 38 cases met the case definition. After enrollment of controls, 7 controls were found to be cases. Therefore, there were total 45 laboratory confirmed cases for analysis.

Among the cases, median age was 35 years, ranged from 20 to 56 years. Male to female ratio was 6.5:1. Seventy percent had primary school education and 47% had agricultural occupation. The revenue income less than 60,000 THB annually was reported for 62%. There were 75% reported history of migrating into other provinces. Seventy percent of HCV cases were smokers and 60% had current alcohol consumption (Table 1). The reported risk behaviors, including previous intravenous drug user (IDU) (58%), tattooing (31%), experienced using commercial sex service (51%) and history of facial shaving by barber (89%), with 47% experienced bleeding during shaving. The risk factors among cases were shown in the Table 3. The reasons of HCV testing were screening during blood donation (48.9%), clinically suspected for hepatitis (28.9%) and abnormal liver function test during physical examination for work permission (13.3%). The clinical presentations at the time of laboratory testing were asymptomatic (55.5%), chronic hepatitis (17.8%), cirrhosis (8.9%) and HCC (2.2%).

Hepatitis B and C Virus

Among the 45 confirmed cases, 39 cases (92.9%) were tested positive by both PCR and ELISA. There were 2 cases confirmed by only PCR, without presenting of antibody, while four cases were confirmed by only ELISA. Forty one cases positive by PCR were subsequently tested for genotype. The genotype identified were genotype 6v (34.1%), 1a (24.4%), 3a (22.0%), 1b (12.2%) and 3b (7.3%) (Table 2). We found active HBV infection with either HBV DNA and HBsAg in HCV infection was as high as 42.2% (19/45), and seven cases (43.8%) were currently dual active infections by presenting of both HBV DNA and HCV RNA viruses circulation in bloodstream of the same patient. Theses seven cases were classified as mostly asymptomatic (71.4%) and two cases were with cirrhosis. The clinical correlation in dual infections was presenting the same as a general case, including 73.7% asymptomatic, 15.8% chronic infection and 10.5% cirrhosis.



Source: Report 506, National Notifiable Disease Passive Surveillance, Bureau of Epidemiology, Department of Disease Control, Ministry of Public Health, Thailand

Figure 1 HCV reported cases from National Notifiable Disease Passive Surveillance of nationwide and Petchabun Province, Thailand, 1998 – 2006

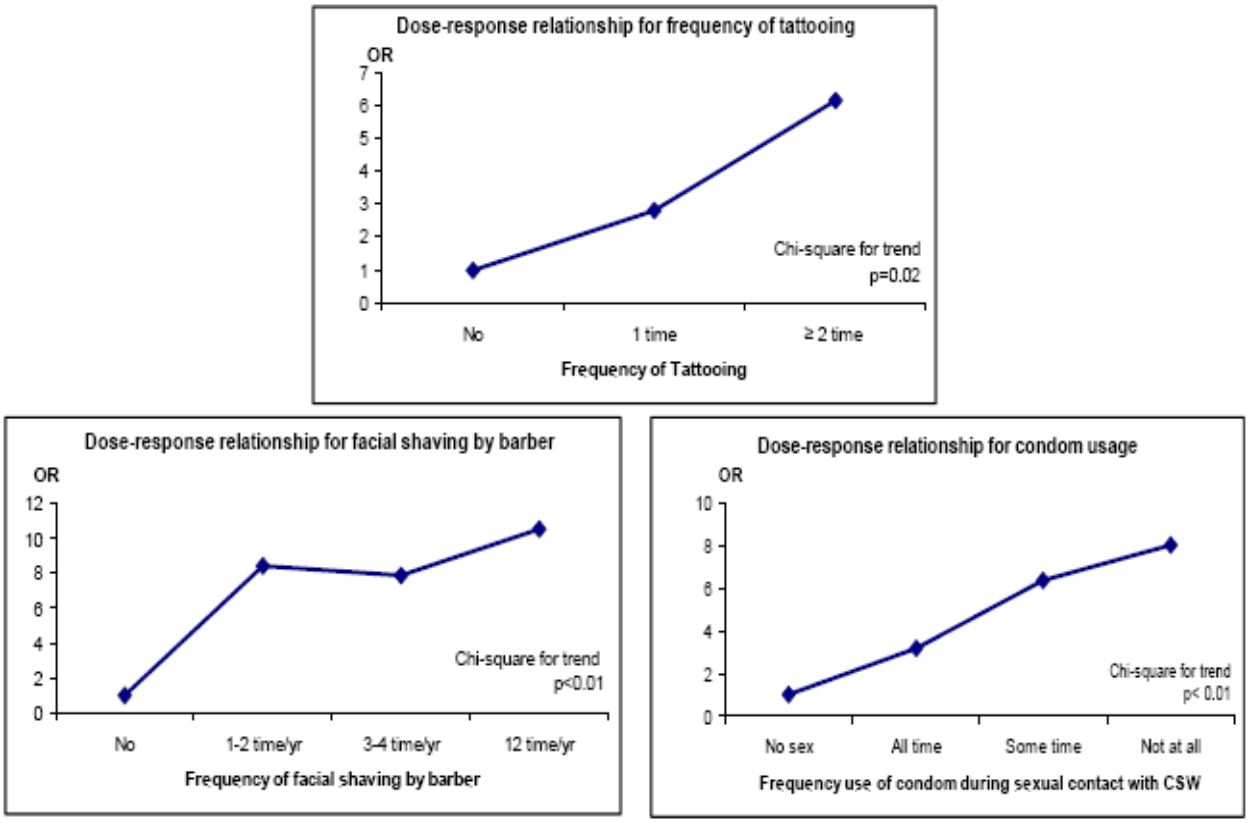


Figure 2 Chi-square for trend of dose-response relationship analysis for risk factors of HCV infection in Phetchabun Province, 2007

Table 1 Demographic characteristic of HCV positive cases and population controls in Phetchabun Province, 2006

Variable	Positive HCV Case (%) N=45	Population Control (%) N=43
Age (yr)		
20-29	6.7	20.9
30-39	68.9	69.8
40-49	22.2	9.3
50-59	2.2	0.0
Median age (min-max)	35 (20-56)	34 (20-47)
Sex		
Male	86.7	34.9
Female	13.3	65.1
Marital status		
Single	15.6	16.3
Married	80.0	81.4
Divorced	2.2	2.3
Separated/Widowed	2.2	0.0
Education attainment		
No attainment	2.2	0.0
Elementary school	68.9	72.1
Middle school	13.3	7.0
High school	6.7	11.6
Bachelor or higher degree	8.9	9.3
Occupation	2.2	14.3
Vacancy	35.6	23.8
Daily Labor	46.7	47.6
Agriculture	4.4	0.0
Company officer	2.2	2.4
Govern officer	8.9	11.9
Freelance		
Annual Income	4.4	11.6
No	62.2	60.5
< 60,000 THB	26.7	25.6
60,000-120,000 THB	6.7	2.3
> 120,000 THB		
Alcohol consumption	44.5	51.2
Nondrinker	35.5	44.4
Some	20.0	4.4
Moderate/heavy		
Smoking habit	33.3	86.0
Nonsmoking	28.9	7.0
Some	37.7	7.0
Moderate/heavy		

Table 2 Laboratory Results of HCV genotype among cases in Phetchabun province, 2006

Genotype of HCV (N=41)	Result (%)
Genotype 1a	24.4
Genotype 1b	12.2
Genotype 3a	22.0
Genotype 3b	7.3
Genotype 6	34.1

Risk factors

There were 45 cases and 43 controls analyzed to determine the association between risk factors and HCV infection (Figure 2). The risk factors found from univariate analysis included male gender (OR = 12.1, 95% CI = 4.2-35.2), history of IDU (OR=18.2, 95% CI = 4.9-67.9), history of tattooing (OR = 3.4, 95% CI = 1.1-10.6), tattooed by friend (OR = 4.5, 95% CI = 1.4-15.2), history of facial shaving by barber (OR = 7.6, 95% CI = 2.5-23.1), history of using commercial sex service (OR = 4.5, 95% CI = 1.7-12.0) and pinna puncturing (OR = 0.3, 95% CI = 0.1-0.7) (Table 3). The dose-response relationship was found for history of tattooing, facial shaving by barber and using commercial sex service (Figure 3). After adjusting all potential factors by multiple logistic regression, the only associated factor was history of IDU (adjusted OR=12.9, 95% CI= 2.2-75.2) (Table 4).

Discussions

Hepatitis C patients in Phetchabun Province was detected incidentally by screening of blood donation, annual health examination or health examination for work permission.

The finding of 16.3% (7/43) HCV infection among controls was unexpectedly high. Estimation of carriers in Thailand by the WHO was only 2.9%[5]. Prevalence of HCV RNA among blood donors in northeastern part of Thailand was 4.5% and prevalence of HCV antibody was 5.6%[8]. In northern region, prevalence of HCV antibody among blood donors was 2.0% and found to be higher among HIV seropositive blood donors (6.2%) [9]. Thus, a study to assess and explore the reason for the high prevalence in Phetchabun was needed.

Genotype of HCV in the province was also interesting due to the highest prevalence of HCV genotype 6 (34.1%). Previous report of HCV genotypes in all regions of Thailand during 2004 revealed that genotype 6 was 8.9% and the most common genotype was 3a (51.1%)[6] while genotype 6 was commonly found in South-East Asian Countries [10,11,12]. Genotype 6 was less well documented for treatment outcome than genotype 1, 2 and 3. There were no association between genotypes and mode of transmission in this study.

The history of using intravenous drug injection was strongly associated with HCV infection, which was consistent with the results of other studies [1,3,13,14,15]. Only few cases were current IDU. The US Center for Disease Control and Prevention (CDC) stated that only IDU and recipients of clotting factors before 1987 were high risk of infection [16]. Although sexual transmission of HCV was still controversial [17,18,19], there were studies demonstrated the sexual transmission as a risk factor [14,20,21]. Thus, condom use was demonstrated for HCV prevention. In this study, there was dose-response relationship for non-condom use during using commercial sex services. Non-sterile equipment for facial shaving or tattooing was found to have dose-response effect. This result was consistent with a study in Pakistan [22].

We found prevalence of HBV and HCV co-infection was 42.2%. The figure was unexpectedly high. The co-infection was documented as the poor prognosis of treatment outcome[1,2]. It implicated that clinicians should order testing HBV for HCV infected patients and vice versa. We observed that the clinical status of the dual infections was not severe which was probably because they were not in the end stage of disease yet.

Viral hepatitis C infection must be considered as a public health issue because it leads to cirrhosis and hepatocellular carcinoma which is a leading cancer

among Thai males. Currently, there are antiviral and interferon for treatment. However, the outcomes were not well approved in some genogroups such as genotype 1 while for genotype 2 and 3, the outcome was better [1,2]. The genogroup 6 was highly prevalence in South-East Asia[2] which was consistence to this study. The evaluation of treatment outcome by interferon alpha with antiviral therapy should be further conducted immediately. Interferon alpha was currently the only measure to reduce the risk of hepatocellular cancer and chronic liver diseases among acute HCV infection. The high prevalence of HCV RNA suggested that the infection was still active and was able to transmit to other people. This group of people should be advised to avoid blood donation and practice safe sexual activities.

Even though this study was not able to demonstrate the risk of blood transfusion, the blood bank in this area and where there is high prevalence of HCV infection should review the screening protocol for HCV. This study found that 2 people had HCV RNA while the antibody for HCV was negative. This finding implies that the screening of HCV by ELISA is not sufficient to prevent infection through blood transfusion. The Thai Red Cross started screening HCV RNA by multiplex nucleic testing (NAT) in blood donors since June 2003. The US CDC guideline recommended to screen persons who ever injected illegal drugs, received a blood transfusion before 1992, received a clotting factor before 1992, received long-term dialysis, children born to HCV positive mother, emergency medical workers after exposure to HCV positive person and persons with evidence of chronic liver disease.

Our limitation included low sample size which might lead to over-estimation of association between interesting risks and outcome. But this effect was neutralized by including seven incidental infected controls in the community. Their exposure factor reduced the strength of association between risks and outcome. The information bias might be occurred during interview because most of cases were from hospital where the hospital staff surely had educated the patients according to knowledge and clinical practice. Furthermore, the recall bias might be affected because the exposure time was so far beyond their clinical appearance.

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Table 3 Univariate analysis for risk factor of HCV infection in Phetchabun Province, 2006

Variables	Case (n=45)	Control (n=43)	Odd Ratio (OR)	95%CI
Gender; Male	39	15	12.1	4.2 – 35.2
Change habitat	33	26	1.8	0.7 – 4.7
Ever married	38	36	1.1	0.3 – 3.3
Elementary education	32	31	1.0	0.4 – 2.4
Agriculture	21	20	1.0	0.4 – 2.3
Low income	30	31	0.8	0.3 – 1.9
Non-alcoholic drinking	26	22	1.3	0.6 – 3.0
Smoking	31	6	13.6	4.7 – 39.8
Hx of IDU in lifetime	26	3	18.2	4.9 – 67.9
Current IDU	2	0	Undefined	Undefined
Hx of tattooing in lifetime	14	5	3.4	1.1 – 10.6
Tattooed by friend	14	4	4.5	1.4 – 15.2
Hx of pinna puncture	14	27	0.3	0.1 – 0.6
Pinna punctured by friend	7	17	0.3	0.1 – 0.8
Hx of foreign body purching	2	1	2.0	0.2 -22.9
Hx of facial shaving by barber	40	22	7.6	2.5 – 23.1
Hx of sexual contact with CSW in lifetime	23	8	4.6	1.7 – 12.0
Hx of sexual contact with CSW in a previous year	6	1	2.5	0.2 – 24.5
Hx of blood received in lifetime	9	5	1.9	0.6 – 6.2
Hx of illegal injected by non-health professional	10	10	0.9	0.3 – 2.5

* Hx = History, IDU = intravenous drug injection, CSW = commercial sex workers

Table 4 Final model of multivariate analysis by multiple logistic regression of risk factor for HCV infection in Phetchabun Province, 2006

Variables	Crude OR (95%CI)	Adjusted OR	95%CI
Male gender	12.1 (4.2 – 35.2)	2.5	0.5 – 13.8
Hx of IDU in lifetime	18.2 (4.9 – 67.9)	9.9	2.1 – 46.5
Hx of tattooing in lifetime	3.4 (1.1-10.6)	1.3	0.3 – 5.5
Hx of pinna puncture	0.3 (0.1 – 0.8)	0.6	0.2 – 2.2
Hx of facial shaving by barber	7.6 (2.5 – 23.1)	2.9	0.7 – 13.0
Hx of sexual contact with CSW in lifetime	4.6 (1.7 – 12.0)	0.6	0.1 – 2.4

* Hx = History, IDU = intravenous drug injection, CSW = commercial sex workers

ปัจจัยเสี่ยงของการติดเชื้อไวรัสตับอักเสบ ซี ในผู้ใหญ่ จังหวัดเพชรบูรณ์ ปี พ.ศ. 2549

บทคัดย่อ:

ปลายปี พ.ศ. 2549 จังหวัดเพชรบูรณ์ได้รับรายงานผู้ป่วยติดเชื้อไวรัสตับอักเสบ ซี เพิ่มขึ้นสามเท่าเมื่อเทียบกับข้อมูลย้อนหลังสามปี นอกจากนั้นรายงานผู้ป่วยจากจังหวัดเพชรบูรณ์คิดเป็นสัดส่วนร้อยละ 26.7 ของจำนวนรายงานผู้ป่วยทั้งประเทศ ทีมสำนักระบาดวิทยา สำนักงานควบคุมและป้องกันโรคที่ 9 พิษณุโลก และสำนักงานสาธารณสุขจังหวัดเพชรบูรณ์รวมทั้งทีมจากโรงพยาบาลเพชรบูรณ์ โรงพยาบาลยุพราชหล่มเก่า และโรงพยาบาลหล่มสัก ร่วมกันสอบสวนโรคเพื่อยืนยันการระบาดและระบุปัจจัยเสี่ยงเพื่อค้นหามาตรการป้องกันควบคุมโรค ทำการศึกษาระบาดวิทยาเชิงพรรณนา โดยการสัมภาษณ์ผู้ป่วยที่บ้านและทบทวนเวชระเบียนของผู้ป่วยในสามโรงพยาบาล (ร้อยละ 98 ของทั้งจังหวัด) โดยมีนิยามผู้ป่วย คือ ผู้ที่มีอายุระหว่าง 20 – 60 ปี ที่มีภูมิลำเนาอยู่ในสามอำเภอ ได้แก่ อำเภอเมือง หล่มสัก และหล่มเก่า และมีผลปฏิบัติการยืนยันการติดเชื้อไวรัสตับอักเสบซีอย่างใดอย่างหนึ่งต่อไปนี้ 1) ให้ผลบวกต่อภูมิคุ้มกันไวรัสตับอักเสบซี 2) พบจีโนมของไวรัสตับอักเสบซีโดยวิธี PCR ศึกษาระบาดวิทยาเชิงวิเคราะห์ เพื่อหาปัจจัยเสี่ยงด้วยวิธี case-control โดยมีนิยามผู้ไม่ป่วย คือ ผู้ที่มีอายุระหว่าง 20 – 60 ปี ที่อาศัยอยู่ในหมู่บ้านเดียวกับผู้ป่วยและให้ผลตรวจทางห้องปฏิบัติการต่อการติดเชื้อไวรัสตับอักเสบซีทั้งสองอย่างต่อไปนี้ 1) ให้ผลลบต่อภูมิคุ้มกันไวรัสตับอักเสบซี (HCV antibody) และ 2) ไม่พบจีโนมของไวรัสตับอักเสบซีโดยวิธี PCR วิเคราะห์ข้อมูลเพื่อหาความสัมพันธ์ของขนาดปัจจัยเสี่ยงโดยใช้ dose-response relationship และควบคุมตัวแปรกวนโดยวิธี multiple logistic regression ด้วยโปรแกรม Epi Info version 3.3.2 (CDC, Atlanta, USA). ผลการศึกษา พบผู้ป่วยไวรัสตับอักเสบซีในรายงาน 506 ของสำนักงานสาธารณสุขจังหวัดเพชรบูรณ์จำนวน 126 ราย อัตราป่วย 12.3 ต่อประชากรแสนคน โดยพบในอำเภอเมือง (ร้อยละ 49.2) หล่มสัก (ร้อยละ 35.7) และหล่มเก่า (ร้อยละ 13.6) ในจำนวนนี้พบผู้ป่วย ที่เข้ากับนิยามผู้ป่วยจากการสัมภาษณ์ในชุมชนจำนวน 43 ราย อายุเฉลี่ยของผู้ป่วยเท่ากับ 35 ปี (20-56) ผู้ป่วยเพศชายต่อเพศหญิงเท่ากับ 6.5:1 ผู้ป่วยส่วนใหญ่มีการศึกษาระดับชั้นประถมศึกษา (ร้อยละ 70) อาชีพเกษตรกรรม (ร้อยละ 47) อัตราส่วนปัจจัยเสี่ยงที่พบในกลุ่มผู้ป่วย ได้แก่ เคยใช้เข็มฉีดยาเข้าเส้นเลือดร้อยละ 58 เคยสักผิวหนังตั้งแต่อายุน้อยกว่า 20 ปี ร้อยละ 31 เคยมีเพศสัมพันธุ์กับผู้ให้บริการทางเพศ ร้อยละ 51 เคยโกนหนวดหรือเคราหลังจากร้านตัดผม ร้อยละ 89 และในจำนวนนี้เคยได้รับเลือดก่อนปี พ.ศ. 2535 ร้อยละ 47 การวิเคราะห์ข้อมูลเปรียบเทียบ (case-control) ปัจจัยเสี่ยงที่พบมากที่สุด คือ การใช้เข็มฉีดยาร่วมกัน รองลงมาเป็นการสักผิวหนัง การโกนหนวด หน้าและ/หรือเคราจากร้านตัดผม และการมีเพศสัมพันธุ์กับผู้ให้บริการทางเพศ ภายหลังจากการวิเคราะห์เพื่อกำจัดตัวกวนโดยวิธี multiple logistic regression พบการใช้เข็มฉีดยาเท่านั้นที่เป็นปัจจัยเสี่ยงอิสระ (adjusted OR=12.9; 95% CI = 2.2-75.2) ส่วนการใช้บริการทางเพศ การโกนหน้าหรือหนวดในร้านตัดผม รวมทั้งการสักพบความสัมพันธ์แบบ dose response relationship (Chi-square for trend <0.05) สรุปและวิจารณ์ การเพิ่มขึ้นของรายงานผู้ติดเชื้อไวรัสตับอักเสบ ซี มีลักษณะผิดปกติ โดยมีสาเหตุจากการใช้เข็มฉีดยาร่วมกัน การใช้บริการทางเพศ รวมทั้งการโกนหนวดโกนหน้า สามารถคาดการณ์ว่าในอนาคตจะมีผู้ป่วยโรคมะเร็งตับในจังหวัดเพชรบูรณ์เพิ่มขึ้น การรักษาผู้ป่วยด้วยการรักษามาตรฐานอาจจะลดความเสี่ยงของการพัฒนาของโรคไปเป็นมะเร็งตับ อัตราการใช้เข็มฉีดยาเสพติดในปัจจุบันลดลงมาก แต่การค้นหาผู้ป่วยและการรายงานยังต่ำกว่าความเป็นจริง ทำให้มีความเสี่ยงจากการติดเชื้อโดยการได้รับเลือด จึงควรมีการศึกษาในจังหวัดเพชรบูรณ์ เพื่อพิจารณาเพิ่มศักยภาพการคัดกรองเลือดโดยใช้วิธีที่มีความไวสูง

คำสำคัญ: ไวรัสตับอักเสบซี, เพชรบูรณ์, ปัจจัยเสี่ยง, ประเทศไทย, การระบาด