

Epidemiology of Hepatitis C in Gulf Countries

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Abstract

Background: Hepatitis C is an inflammatory and infectious disease of liver caused by hepatitis C virus. Hepatitis C considered one of the leading causes of morbidity and mortalities all around the world. Hepatitis C is a pandemic but its regional distribution, prevalence rate and risk factors are variable. Over all HCV prevalence and incidence rate is higher for developing and under developed poor countries as compared to developed countries. **Aim:** Currently available data on the prevalence of hepatitis C is sketchy and insufficient to draw a clear picture, especially in Gulf region. Purpose of taking up this systematic review is to identify gaps present in the data available and establish a composite understanding on etiological, epidemiological and risk factors associated with hepatitis C. **Methodology:** This systematic review was conducted by searching for articles through PubMed with the help of key phrases and terms in order to retrieve studies done on HCV prevalence and incidence in Gulf region. **Results:** After screening articles that met inclusion criteria, 20 were selected according to their relevance to the topics. Out of these ten articles, three were retrospective studies, three were cross-sectional, three were cohort, and one was longitudinal study. Two of the articles were based on the review of existing literature while remaining eight assessed HCV prevalence in different countries of Gulf region with respect to detection of HCV antibodies and risk factors. HCV genotype 1 was most prevalent type in Gulf region. Intravenous drug use, blood transfusions and nosocomial mode of transmission were the most common means of infection. Adults above the age of 35 and males were more exposed to HCV as compared to younger individuals and females. **Conclusion:** Data available on HCV prevalence is limited and has certain limitations. There is need for extensive research especially in Gulf region. Greater focus is needed on cross-sectional studies in order to establish relation between variables and infection transmission.

Keywords: HCV, hepatitis C, epidemiology of HVC, risk factors, HCV prevalence

Background

Hepatitis C is an inflammatory and infectious disease of liver caused by hepatitis C virus (Center for Diseases Control and Prevention, 2016). HCV is a blood borne flavivirus and its target host cells are hepatocytes (liver cells) and B lymphocytes (Zignego et al., 1995). According to Lavanchy (2011), after its discovery in 1989, Hepatitis virus C was believed to infect only specific individuals such as those who received blood transfusion or used intravenous drugs. But now it is a clearly established fact that Hepatitis C virus is a pathogen that is globally prevalent and is one of the main causes of liver diseases especially cirrhosis (Kauhl et al., 2015).

Hepatitis C considered one of the leading causes of morbidity and mortalities all around the world (Cooke et al., 2013). As of 2004 there were 123 million global cases of hepatitis C as reported by WHO (Perz, 2004) and by 2011, 160 million chronic cases with a global prevalence rate of 2.35% were reported (Lavanchy, 2011).

Studies have shown that chronic or persistent hepatitis C infection often progresses and leads to the development of cirrhosis, hepatocellular or liver cell carcinoma, permanent liver failure and ultimately death (Lauer & Walker, 2001). Subsequent studies have shown that ten to twenty percent cases of chronic hepatitis are prone to certain complexities such as cirrhosis and about 1-5% of the cases are likely to progress towards cancer formation (Di Bisceglie et al., 1991; Fattovich et al., 1997; Seef et al., 1992; World Health Organization, 2004).

Hepatitis C is a pandemic but its regional distribution, prevalence rate and risk factors are variable (Hahné et al., 2013; Shepard, Finelli & Alter, 2005). Over all HCV prevalence and incidence rate is higher for developing and under developed poor countries as compared to developed countries of Europe and North America (Mohamed et al., 2015). As of 2002, 1.6% population of U.S was infected with HVC and 15000 HVC related deaths were reported in 2007 (Alter et al., 1999; Mohammed, Martin, Sadashige, Jake & Paul, 2013). In Africa HCV prevalence rate is 51% (Triki et al., 1997), 0.58 % in China (Xia, Luo, Bai & Yu, 2008), India has an overall prevalence rate of .09 to 7.89% as reported by Mukhopadhyaya (2008) and 5.9% in Pakistan

(Waheed, Shafi, Safi & Qadri, 2009). Egypt has a very high HCV prevalence rate, reaching up to 32% (Arthur et al., 1997; El Gohary et al., 1995).

Messina et al. (2015) carried out a study on countries that have been marked by WHO as Global Burden of Disease (GBD) region in order to determine the prevalence of hepatitis C with respect to its genotypes. Researchers found that genotype 1 was responsible for more than 46.2% cases of HCV and more than one third cases were reported in East Asia. Same study also observed that genotype 3 was the second most commonly reported strain of HCV that was responsible for 30.1% cases of hepatitis C, most of which were reported in South Asia region. Messina et al. (2015) also concluded that North Africa and Middle East had most of the hepatitis C cases caused by genotype 4 while genotype 5 caused less than one percent cases annually with most cases reported in South and East Africa.

Hepatitis C has multiple risk factors associated with it because of different modes of transmission. Initially blood transfusion was the major source of HVC infection then intravenous drug use became major source of virus transmission and now it has become nosocomial infection; hospitals becoming major source of infection (Desenclos, 2000). Since it is blood borne, most common routes of HCV transmission are: transfusion of infected blood, sharing or reuse of injecting or improperly sterilized hospital equipment contaminated with the blood of an infected person (WHO, 2014). According to Lauer and Walker (2001) and WHO (2016), HCV can be transmitted through sexual contact or from infected mother to child during child birth but likelihood of such transmission is fairly low. Likewise, bodily fluids like saliva also contain HCV but infective potential of saliva is low and thus chances of contracting HCV from saliva or fluids like semen is comparatively lower (Ferreiro, Dios & Scully, 2005).

Healthcare workers are put on an increased risk of contracting HCV because they are percutaneously exposed to cut and pinch injuries from contaminated needles and incision tools or form coming in direct contact with certain diagnostic tools like colonoscope (Sanders et al., 2005). In different studies the likelihood of contracting HVC from needle injury at hospitals was 0 to 13% (Baldo, 2002; Lanphear et al., 1994; Sulkowski, Ray & Thomas, 2002). Patients

themselves are exposed to the risk of contracting HCV from hospitals. According to Ross, Viazov & Roggendorf (2000) there have been reports whereby surgeons carrying HCV infected the patient during gynecological and cardiac procedures (Brown, 1999). Authors continue that for an infected surgeon the probability of transmitting the infection to patients in a period of thirty years is 88%.

Individuals who are involved in the use of injection drugs are the population group most vulnerable to hepatitis C (Alter et al., 1999). More than 50% of new hepatitis C cases in U.S are linked with the use of intravenous drugs and is associated with up to 90% long time users of intravenous drugs are infected with HCV because of shared needles and other drug paraphernalia (Hagan et al., 1999). Researchers have observed that transmission of hepatitis C virus through parenteral routes is ten times more potent as compared to that of HIV (Mitsui et al., 1992).

Another risk factor associated with the hepatitis C infection is the unsafe sexual behavior of individual (Memon & Memon, 2002). Though sexual transmission of HCV is infrequent, likelihood is higher for individuals who have multiple partners, who have partner who is already infected with hepatitis C, or having partner who is intravenous drug user (Terrault, 2002). Individuals who have a history of sexually transmitted diseases particularly those with HIV are at an increased risk for hepatitis C (Hershow, Kalish, Sha, Till & Cohen, 1998).

Transmission of hepatitis C during pregnancy and childbirth is another risk factor but exact route for this mode of transmission needs more study (Memon & memon, 2002). In a study carried out by Gibb et al. (2000) on mother and infants in UK and Ireland region showed that there was 6.7% prevalence of vertical transmission of hepatitis C from mother to child. Researchers observed that this rate was 3.8 time higher for mothers who also had HIV. Further it was concluded that mostly hepatitis C virus transmission occurred around at the time of delivery.

People from specific ethnicity and different age groups have been reported to be on greater risk for hepatitis C. in a study carried out by Mendenhall et al. (1993), African and Hispanic Americans had 2.4 times more chance of contracting hepatitis. This same study also revealed that chances of HCV infection also increase with advancing age. Chung, Ueda & Kudo (2010) also

observed that prevalence of hepatitis C is lower in younger generation as compared to those above the age of 55 years. Akbar, Basuki, Garabrant, Sulaiman & Noer (1997) concluded from their comparative study on hepatitis B and C that unlike hepatic B, Hepatitis C is not affected by family size and socioeconomic status but with the history of blood transfusion, age and intravenous drug use history.

Jafari, Copes, Baharlou, Etminan & Buxton (2010) conducted a meta-analysis on 124 studies and concluded that tattooing is an additional risk factor in the transmission of hepatitis C infection. Authors suggested that younger generation that has been incarcerated is more prone to developing HCV as tattooing is a common activity in prisons.

Aims of review

Currently available data on the prevalence of hepatitis C is sketchy and insufficient to draw a clear picture, especially in Gulf region. Purpose of taking up this systematic review is to analyze findings of various researches that have been carried out until recently. It also aims to identify gaps present in the data available and establish a composite understanding on etiological, epidemiological and risk factors associated with hepatitis C. Criteria used for selecting the articles includes the presence of clinical samples along with various risk factors associated with prevalence and incidence rate of hepatitis C. Articles that focused on disease treatment and diagnosis were excluded because of irrelevancy with research question.

Methodology

This systematic review was conducted by searching for articles that centered on hepatitis C and its epidemiology. Articles were obtained through electronic search on PubMed by using generic and advances search option. Key phrases used for extracting the articles included but were not limited to: hepatitis C, prevalence, epidemiology, Gulf region, hepatitis C in Gulf region, Saudi Arabia, Bahrain, Qatar, Oman, United Arab Emirates, genotypes, risk factors, HCV. English was selected as main language medium to streamline search results.

Studies that were carried out for hepatitis C in population of Gulf region formed major basis of inclusion criteria. Inclusion was further subjected to fulfil the criteria of disease prevalence, incidence and risk factors. Further, sample size and sample setting (such as hospitals and clinics), sample's demographic diversity, current and retrospective studies were given special emphasis. Based on the key phrases and advanced search, a total of 390 articles were obtained (Figure 1). Out of these 390 articles 363 were found to be non-relevant while remaining 27 had relevancy to the research topic. From these 27 articles 20 were selected by screening for relevance to the topics. Duplicate articles were removed. Selection was further narrowed down for relevance by reading abstract of 11 of these 20 articles and full text of remaining nine. Finally, ten articles were separated for review with respect to research question. Selected articles fulfilled the inclusion criteria. Additionally, all of them with the exception of one were no older than 2000 and hence provided most recent epidemiological analysis of hepatitis C. Articles that were excluded focused more on treatment and diagnosis of disease rather than its prevalence and incidence factors, thus they were excluded on the basis of their study design. Author name, paper title, publication year, country in Gulf region, demographic characteristics, sample size, prevalence and incidence rate, scope of study, risk factors and significant findings were the data extracted from selected articles.

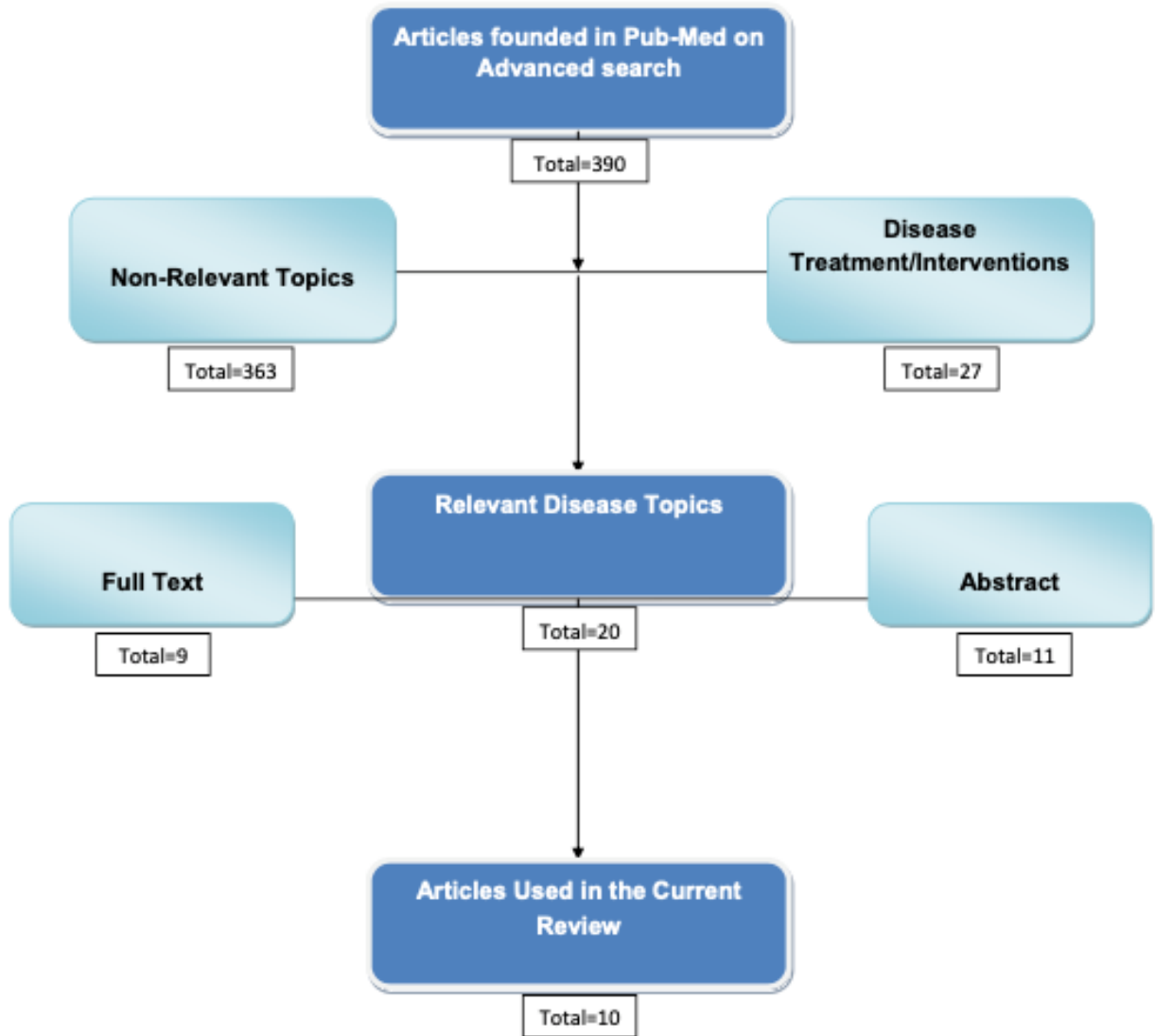


Figure 1. Flow chart showing article selection

Table 1: Basic characteristic description of the articles used in the current review

No	Author	Location	Publication date	Study Design	Main findings
1	Mohamoud, Y. A., Riome, S., & Abu-Raddad, L. J. (Gulf region	2016	Retrospective	HCV prevalence was highest for UAE nationals, amongst expatriates Egyptians had highest HCV prevalence rate. Intravenous drug users and individuals having multiple blood transfusions were amongst high risk groups.
2	Aljumah et al.	Kingdom of Saudi Arabia	2016	prospective cohort study	Prevalence rate in adult population was 1.08%, in children younger than 15 yrs 0.19%. Over all prevalence in Saudi nationals was 0.7%. Prevalence found to be higher in males and comparatively lower in females. Most cases for HCV were reported for adults aged 40-44. Disease burden in year 2014 was 75,400 to 181,000 and by 2030 the prevalence is projected to increase by 190%
3	Janahi et al.	Bahrain	2015	Cross-sectional	HCV genotypes were dominant in following order type 1>type3 and 4>type 2
4	Sharma et al.	Qatar	2015	cohort based retrospective	over all HCV prevalence and incidence rate in natives of Qatar was found to be low. Major causal for HCV transmission was blood transfusion and use of intravenous drugs.
5	Fallahian, F., & Najafi	Middle East	2011	Restrospective	HCV transmission from mother to child and sexual contact is low as compared to infection transmission from medical instruments, non-screened blood transfusions and intravenous drug use. Patients undergoing dialysis were also found to be at greater risk of HCV.

6	Abro, A. H., Al-Dabal, L., & Younis, N. J.	Dubai	2010	Cross-sectional	42.6% of the population had history of intravenous drug use, 32.7% contracted infection owing to sexual contact, 21.5% had tattoos while 19.2% has a history of blood transfusion. In nationals as well as expatriates, genotype 1 was predominant.
7	Bener, A., Al-Kaabi, S., Derbala, M., Al-Marri, A., & Rikabi, A	Qatar	2009	Restrospective	HCV incidence rate was 6.3. More males as compared to females were found affected by hepatitis C with a significance factor of $p=0.008$. Adults above the age of 35 years were more affected by HCV.
8	Madani	Kingdom of Saudi Arabia	2007	longitudnal study	24,948 HCV cases were reported, 76.9% cases were of Saudi nationals. 124 cases per 100,000 cases were reported with number of cases for children younger than 15 years of age being 0.012% and adults ranging up to 0.202% per 100,000 cases. Blood transfusions and use of intravenous drugs were determined to be major risk factor.
9	Shobokshi et al.	Kingdom of Saudi Arabia	2003	cohort study	Blood donors had a seroprevalence of 1.1%. Children showed prevalence of 0.1% and 0.7% in pregnant women. High risk groups were hemodialysis patients and intravenous drug users who demonstrated a prevalence rate of 55.7% and 14% respectively.

10	Al-Faleh et al.	Kingdom of Saudi Arabia	1991	Cross-sectional	Inverse relation between age and HCV prevalence. Children younger than 3 years of age had a higher prevalence of 1.2% and lower for children aged 7 years and above (0.6%). Children belonging to middle class showed higher HCV prevalence as compared to those from lower class.
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Result

Basic characteristic description of the studies undertaken for this review is given in table 1 summarized details are as follows:

First selected article was a systematic review by Mohamoud, Riome and Abu-Raddad (2016). Purpose of this review was to analyze and compose epidemiological data regarding hepatitis C prevalence in Gulf region in nationals as well as emigrants. Study showed a prevalence measure of 557 and incidence rate of one in Gulf region. HCV prevalence amongst nationals was 0.24% with a 95% Confidence Interval (CI) of 0.02–0.63 in UAE, for Kuwait prevalence was 0.4% with a 95% CI of 0.43-0.59, and 1.65% for Saudi Arabia (95% CI=0.96-2.49). For overall resident population HCV prevalence was highest for UAE with a rate of 1.64% followed closely by Saudi Arabia with a prevalence of 1.63%; lowest prevalence was obtained for Bahrain with a value of 0.30%. Further amongst expatriates, highest prevalence rate was obtained for Egyptians. In case of high-risk population groups, individuals who had multiple blood transfusions had highest HCV prevalence ranging as high as 78.6% and 74.6% in individuals who used intravenous drugs.

Aljumah et al. (2016) conducted research in Saudi Arabia in the year 2014. Aim of this study was to determine epidemiology of HCV for year 2014 and estimate current and future burden of HCV in kingdom of Saudi Arabia, making it a prospective cohort study. Cohorts based on age and gender was specified to study HV incidence and prevalence. Obtained data was subjected to statistical analysis through “disease progression model”. Future estimates were made by applying progression rates to previously obtained results. Results of both analyses showed that HCV

prevalence rate in adult population was 1.08% while that in children younger than 15 years was 0.19%. Over all prevalence in Saudi nationals was 0.7%. Prevalence of hepatitis c was higher in males and comparatively lower in females. Most cases for HCV were reported for adults aged 40-44. Disease burden in year 2014 was 75,400 to 181,000 and by 2030 the prevalence is projected to increase by 190%.

Janahi, Al-Mannai and Jahromi (2015) conducted a study in Bahrain. Purpose of this research was to determine hepatitis C prevalence and distribution of its various genotypes in a sample of patients with HCV. Research was carried out by obtaining a serum sample from 202 hepatitis C positive patients. Researchers found that most dominant HCV genotype in Bahrain was type 1 followed by type 3. Type 1 accounted for 36.7% prevalence while type 3 and 4 both accounted for 15.6% occurrences. Genotype 1 was most commonly observed in patients between the ages of 51 to 60 (38.3%). Genotype 2 was more common (60%) in patients between 21-30 years of age while genotype 3 accounted for 30% population of 51 to 60 years of age. Individuals 60 years and above had highest percentage (40%) of genotype 4. Within sample group of 51 to 60 years old, percentage of male patients was higher while females were more abundant in age group of 41 to 50 years old. Over all HCV prevalence in Bahrain was found to be 0.99% with male patients making up 71.1% of the proportion and female patients making up 28.9% of the studied sample.

Sharma et al. (2015) carried out a screening study on hepatitis C in high-risk groups of Qatar. Research methodology comprised of community-based screening of 13,704 medium and high-risk individuals (1% population of Qatar) at “point of care testing” centers in Doha over a period of 16 months. Tested population was between 18 and 65 years of age. Screened population involved natives as well expatriates. Study showed that HCV prevalence in medium risk population was 0.8% while 3.2% in high-risk population. An overall prevalence rate of 2% (95% CI= .8–2.2%) was determined for the screened individuals. Over all, HCV risk was found to be lower for population of Qatar. Nevertheless, medium risk individuals were found to sustain HCV for a longer duration.

Fallahian and Najafi (2011) executed a review of hepatitis C epidemiology in Middle East region. Prevalence and risk factors for hepatitis c virus was assessed for Iran, Bahrain, Oman, Iraq, Jordan, Saudi Arabia, UAE, Qatar, Cyprus, Egypt, Syria and remaining other countries of this region. For each of these countries different prevalent rates and risk factors were identified. Variations were observed within these countries and Middle East region as a whole. An overall review suggested that HCV transmission frequency within family, from mother to child and sexual contact is low as compared to infection transmission from medical instruments, non-screened blood transfusions prior to 1990 and intravenous drug use. Patients undergoing dialysis were also found to be at greater risk of HCV.

In a descriptive study by Abro, Al-Dabal and Younis (2010) distribution of HCV genotypes was determined in Dubai. This assessment was done over a period of six months at an infectious disease's clinic. Final sample size comprised of 223 patients out of which 124 were natives of UAE while 99 were expatriates. All patients were between 14 and 77 years of age. It was found that amongst nationals, genotype 1 was most dominant making up 29.2% of the studied samples. Type 3 was found in 24.6% of sample and type 4 made up 1.6% of the sample. Likewise, genotype 1 was also found to be highly prevalent amongst expatriates. In UAE nationals, 52% of male population had genotype 1 and 42.7% had genotype 3. For females, genotype 4 was more predominant making up 46.4% of population. 42.6% of the population showed history of intravenous drug use, 32.7% demonstrated the presence of infection owing to sexual contact, 21.5% had tattoos while 19.2% has a history of blood transfusion.

Bener, Al-Kaabi, DerbalaAl-Marri and Rikabi (2009) carried out a retrospective cohort study in Qatar to determine the incidence of all three types of hepatitis in Qatar. This research was carried out over a period of five years from 2002 to 2006 in a hospital in Qatar. Amongst all the reported cases of hepatitis, 527 cases were of hepatitis C. Incidence rate of hepatitis C per 10,000 populations was 6.3. Ratio of hepatitis B and C was observed to be higher for male population as compared to females. Hepatitis C was predominant in adults aged 35 and above. Difference associated with gender related prevalence of hepatitis C had a significance of $p=0.008$. It was

concluded that incidence rate of hepatitis C in Qatar was higher as compared to other countries in Gulf region. Most of the new cases of HCV were associated with blood transfusions.

Madani (2007) conducted a descriptive case study in Saudi Arabia on HCV cases reported over a period of ten years. Total 24,948 HCV cases were reported out of which 76.9% cases were of Saudi nationals. 124 cases per 100,000 cases were reported with number of cases for children younger than 15 years of age being 0.012% and adults ranging up to 0.202% per 100,000 cases. This study concluded that lower incidence rate amongst children indicated that mother to baby mode of transmission of HCV was very rare. Blood transfusions prior to 1990 and use of intravenous drugs was the major source of hepatitis C transmission.

Shobokshi et al. (2003) carried out cohort study on HCV prevalence in Saudi Arabian population. Prevalence of HCV in serum samples obtained from blood donors, pregnant women, young children, Intravenous drug users and hemodialysis patients was determined. All cohorts were screened for HCV antibodies for five years from 1998 to 2002. High risk population groups were also identified. Out of 55,7813 samples, 6313 were positive for HCV antibodies. It was observed that blood donors in Saudi population had an HCV seroprevalence rate of 1.1%, children showed prevalence of 0.1% and 0.7% in pregnant women. Two high risk groups were hemodialysis patients and intravenous drug users who demonstrated a prevalence rate of 55.7% and 14% respectively.

Al-Faleh et al. (1991) conducted a community-based study in Saudi Arabia to determine the prevalence of HCV antibodies in children of ages from one and ten. 496 Saudi children between the ages of one and ten were screen for HCV antibodies. 0.90% of the children were found positive for HCV antibody. There was no significant difference in prevalence between males and females for this age group. Inverse relation between age and HCV prevalence was observed. Children younger than 3 years of age had a higher prevalence of 1.2% and lower for children aged 7 years and above (0.6%). Risk factors were assessed with respect to socio economic status of children. Children belonging to middle class showed higher HCV prevalence as compared to those from

lower class. Over all HCV prevalence in young children was observed to be low. Nevertheless, its detection indicated probable transmission in very early life years.

Discussion

This study was based on the review of 10 research articles that analyzed hepatitis C epidemiology in different countries of Gulf region. Given the results of all these articles, major findings include that prevalence of hepatitis in Gulf region is comparable to that of other countries. Interfamilial, from mother to child and sexual contact rarely acts as a transmission source for hepatitis C. Most of the cases of hepatitis C antibody detection are attributable to blood transfusions that were carried out before 1990. Second major risk factor of HCV is the use of intravenous drugs whereby sharing of needles leads to spread of hepatitis C. Genotype 1 was found to be most common type of hepatitis C virus prevalent in Gulf region (Abro, Al-Dabal & Younis, 2010; Janahi, Al-Mannai & Jahromi, 2015; Mohamoud, Riome & Abu-Raddad 2016). In all of these studies, demographics and age distribution played a key role. Males were more affected and more likely to develop HCV as compared to females. Individuals between the ages of 35 (Bener, Al-Kaabi, DerbalaAl-Marri & Rikabi, 2009) and 44 (Aljumah et al. 2016) were reported to have highest HCV prevalence.

Studies undertaken for this review had certain limitations. In paper by Shobokshi et al. (2003), ethnic differences and prevalence of disease in not natives were not taken into account. In work by Madani (2009), under reporting was the major limitation. Actual magnitude of HCV cases might have been under or over-estimated because of testing of low risk and high risk groups respectively. Additionally, it was a descriptive conclusive study rather than being a cross-sectional survey because of which there is an inherent risk of under or over-estimation. Demographic and risk factors were not properly correlated in study by Bener, Al-Kaabi, DerbalaAl-Marri and Rikabi (2009). Availability of sufficient data, lack of in-depth analysis and failure to take into account several important risk factors were some major limitations in all of the ten reviewed papers. Because of these limitations, current review is also prone to some shortcomings. Primary limitation of this study is the unavailability of comprehensive information on hepatitis C prevalence in Gulf

countries with respect to certain risk factors. The data that is available is generic and extensive details on any one significant factor are missing. Therefore, results of this systematic review are also somewhat inclined towards biasedness. It is better to utilize the outcomes of this review as a brief overview of HCV prevalence in Gulf region but not as an accurate assessment of situation.

Major strength of this review is that it has utilized latest findings on the prevalence of HCV with the exception of one paper that was from 1991. This review has provided a general understanding of epidemiology of hepatitis C in major countries of Gulf region. Findings of this review are comparable to international results. An overall HCV prevalence level of 1% has been concluded for all countries of Gulf regions. This figure is comparable to that reported by Mohd Hanafiah, Groeger, Flaxman and Wiersma (2013) and Cornberg, et al. (2011) for different developing and under developed countries. Study also showed that percentage of HCV prevalence in expatriates reflects the prevalence level in their native countries. For example, Mohamoud, Riome and Abu-Raddad (2016) observed that Egyptian expatriates had highest HCV prevalence level. Similarly high ratio of 14.7% had been reported by El-Zanaty and Way (2013). This review found that genotype 1 is the most common type of hepatitis C virus prevalent in Middle East region whereas Pacsa, Al-Mufti, Chugh and Said-Adi (2001) have reported higher ratio of genotype 4 in Kuwait and Saudi Arabia and Iraq region.

Higher prevalence of HCV in intravenous drug users was repetitively reported in all of reviewed papers. This finding is in line with international trends and other studies carried out in same region (Alter 2007; Shepard, Finelli & Alter 2015). Similar findings have been reported by Pawlotsky et al. (1996) and Zein (2000), who reported association of HCV genotype 3a and 2c with intravenous drug users in United States. Blood transfusions are another risk factor for HCV transmission as per findings of this systematic review. In these papers different prevalence rates were reported for transfusion related HCV transmission. In this case as well, similar observations have been reported at international level (Alavian, Gholami & Masarrat, 2002; Savvas et al., 2005). Savvas et al. (2005) observed that out of a sample of 436, 167 individuals had a history of blood transfusion related HCV infection. 15.2% of drug users had genotype 3 HCV. Our review also

showed varying trends of HCV prevalence in terms of its different genotypes. These findings were in line with international studies. However, these results were inconsistent with the findings reported by Kabir, Alavian and Keyvani (2006) and García-Montalvo & Galguera-Colorado (2008).

Conclusion

Given the lack of research and data available on HCV prevalence in Gulf region, it is necessary to carry out a deeper and extensive research, especially cross-sectional studies. More risk factors need to be considered when studying epidemiology of HCV. As a whole, blood transfusion, intravenous drug use and use of contaminated medical instruments are the major risk factor. Drug users and receptors of multiple blood donors are amongst high-risk groups. HCV genotype 1 is most commonly prevalent in Gulf region followed by genotype 3. Most of the data is available for Qatar, Bahrain and KSA but large-scale cohort studies are needed for other countries of this region. Current review has certain future implications for health industry as it will help in formulating prevention strategies for controlling the spread of hepatitis C infection.

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