Case Report

A case of hepatitis C virus transmission acquired through sharing a haemodialysis machine

Peter C. Thomson¹, Craig Williams², Celia Aitken³, Jonathan Ball⁴, Natalia Wysocka⁴, Richard Brown⁴ and R. Stuart Rodger⁵

¹Renal Unit, Glasgow Royal Infirmary, Glasgow, UK, ²Infection Control NHS Greater Glasgow and Clyde, Glasgow, UK, ³Department of Virology, Gartnavel General Hospital, Glasgow, UK, ⁴School of Molecular Medical Sciences, University of Nottingham, Nottingham, UK and ⁵Renal Unit, Western Infirmary Glasgow, Glasgow, UK

Correspondence and offprint requests to: Peter C. Thomson; E-mail: peter.thomson@nhs.net

Abstract

Hepatitis C virus (HCV) infection is a significant problem among haemodialysis populations worldwide. ‘Horizontal’ cross-infection between patients can occur, predominately through direct environmental transmission of the virus. Current guidelines thus recommend universal barrier precautions, however they do not suggest using dedicated machines for HCV-positive patients to prevent the ‘sequential’ transmission of virus to those who subsequently use that machine. We report a case where sequential HCV transmission occurred from a patient of low infectivity with no identifiable machine fault. We suggest that current guidelines should be reviewed to encourage the use of dedicated haemodialysis machines for HCV-positive patients.

Keywords: haemodialysis; hepatitis; infection

Background

Hepatitis C virus (HCV) infection is a common finding among haemodialysis populations worldwide. Acute HCV infection significantly increases the risk of chronic HCV infection with a significant impact on the likelihood of progressive hepatic damage, hepatic failure and death [1]. Haemodialysis populations are at a heightened risk of acquiring and expressing HCV infection [2], and cross-infection between patients who undergo haemodialysis concurrently within centres has been well documented [3,4]. Several guideline bodies have advocated the use of standard infection control precautions to prevent nosocomial spread [5,6], and these practices have been shown to significantly reduce the risk of cross-infection between haemodialysis patients [7]. Transmission of HCV to sequential patients using the same haemodialysis machine, however, has not been widely reported, and thus, guideline groups do not advocate the use of dedicated haemodialysis machines for HCV-positive patients.

We report a case where viral gene sequencing and phylogenetic analysis strongly suggest HCV transmission from a patient of low infectivity to a patient who shared the same haemodialysis machine. In this situation, no fault with the dialysis machine in question was recognized either at the time or subsequently. This case brings into question the current guideline recommendations.

Case report

A 51-year-old woman with established renal failure due to diabetic nephropathy had been receiving regular haemodialysis three times per week at her regular outpatient haemodialysis unit for 7 years. A policy of routine three-monthly blood sampling for the presence of hepatitis B surface antigen and hepatitis C antibodies was in place, and this patient demonstrated consistently negative results throughout their time on renal replacement therapy.

In early September 2009, an HCV antibody titre for the patient was reported as ‘equivocal’. Repeat testing 9 days later demonstrated an HCV antibody titre of 10.23 IU with a corresponding HCV polymerase chain reaction (PCR) titre of 8195 IU/mL (3.9 log copies). Retrospective analysis of the preceding sample taken in June 2009 confirmed HCV PCR positivity and thus suggested acute infection. Serum alanine transaminase titres were noted to be consistently <30 IU/mL, while hepatitis A, hepatitis B, HIV and autoantibody screening were negative.

The patient had no history of other risk factors for HCV transmission. She had never injected drugs nor undergone tattooing and had not received blood products during the 12 months prior to the first positive HCV PCR result. All patients who attended the same outpatient haemodialysis facility during the time of the possible transmission were HCV antibody negative. The index patient had however been admitted to a renal inpatient unit for a period of 10 days in late March/early April 2009 during treatment...
for an infected diabetic foot ulcer. At this time, she received four separate haemodialysis sessions at the hospital’s inpatient dialysis facility. On one occasion, the patient underwent haemodialysis using a machine immediately following a known HCV-positive patient. Subsequent viral genotyping demonstrated HCV 3A genotype in both patients. Consensus full-length E1E2 sequencing/phylogenetic analysis on samples from the recipient and suspected source, together with nine Nottingham and eight Glasgow epidemiologically unrelated genotype 3A control samples, were conducted. Bootstrapped replicate trees for hepatitis C nucleic acid and amino acid sequencing (Figures 1 and 2) were generated for the suspected source (prefix “IC”), suspected recipient (prefix “HS”), and additional samples from nine Nottingham (prefix “UKN”) and eight Glasgow (prefix “P”) HCV 3A genotype controls. This shows a clustering of the source and recipient viruses being supported by 100% of the bootstrapped replicate trees.

Discussion

HCV infection in haemodialysis units can be relatively common. Prevalence varies with geography and remains relatively high despite a decrease being demonstrated in European countries following the introduction of routine blood product screening in the early 1990s [2]. Prevalence estimates in the Dialysis Outcomes and Practice Patterns Study (DOPPS) averaged 13.5%, although they varied from 2.6% to 22.9% between participating countries [8]. Similar variation in prevalence has recently been reported in Asia-Pacific countries [9].
‘Horizontal’ cross-infection between haemodialysis patients can occur, predominately through direct environmental transmission of the virus. This is evidenced through the finding of higher rates of seroconversion in haemodialysis patients compared with peritoneal dialysis patients [9], increased seroconversion in those who were dialysed immediately adjacent to HCV-positive patients [7], and lower rates of seroconversion where physical isolation of the patients has occurred [3,10]. HCV incidence has decreased in units where rigorous infection control policies targeting nosocomial spread have been applied [7]. HCV outbreaks have also occurred where poor compliance with standard infection control measures has been found [4].

These findings have translated into guideline bodies recommending that universal precautions to prevent nosocomial spread be applied [5,6]. Guideline bodies have, however, stopped short of recommending the use of dedicated machines to prevent sequential transmission of HCV.

In this case, sequential HCV transmission seems to have occurred despite conforming to current guidance in practice. Our local response to this case has been to ensure that all HCV-positive patients use dedicated haemodialysis machines that are not to be used in patients who are HCV negative. Our standard infection control practices have remained in place, but we have not sought to isolate physically the HCV-positive population from the HCV-negative population within our units.

We recommend that, in the light of this case, future blood-borne virus guidelines be extended to advocate the use of dedicated machines in the HCV-positive population.

Conflict of interest statement. None declared.

References

1. Niederau C, Lange S, Heintges T et al. Prognosis of chronic hepatitis C; results of a large prospective cohort study. Hepatology 1998; 28: 1687–1695
2. Jadoul M, Poignet JL, Geddes C et al. The changing epidemiology of hepatitis C virus (HCV) infection in haemodialysis: European multicentre study. Nephrol Dial Transplant 2004; 19: 904–909
3. dos Santos JP, Loureiro A, Cendoroglo Neto M et al. Impact of dialysis room and reuse strategies on the incidence of hepatitis C virus infection in haemodialysis units. Nephrol Dial Transplant 1996; 11: 2017–2022
4. Okuda K, Hayashi H, Kobayashi S et al. Mode of hepatitis C infection not associated with blood transfusion among chronic hemodialysis patients. *J Hepatol* 1995; 23: 28–31
5. Geddes C, Lindley E, Duncan N. UK Renal Association Clinical Practice Guidelines—Blood-borne Viruses. *UK Renal Association* 2009
6. KDIGO. Guideline 3: preventing HCV transmission in hemodialysis units. *Kidney Int* 2008; 73: S46–S52
7. Jadoul M, Cornu C, van Yperselle de Strihou C, and the Universitaires Cliniques St-Luc (UCL) Collaborative Group. Universal precautions prevent hepatitis C virus transmission: a 54 month follow-up of the Belgian multicenter study. *Kidney Int* 1998; 53: 1022–1025
8. Fissell RB, Bragg-Gresham JL, Woods JD et al. Patterns of hepatitis C prevalence and seroconversion in hemodialysis units from three continents: the DOPPS. *Kidney Int* 2004; 65: 2335–2342
9. Johnson DW, Dent H, Yao O et al. Frequencies of hepatitis B and C infections among haemodialysis and peritoneal dialysis patients in Asia-Pacific countries: analysis of registry data. *Nephrol Dial Transplant* 2009; 24: 1598–1603
10. Jadoul M, Cornu C, van Ypersele de Strihou C. for the UCL Collaborative Group. Incidence and risk factors for hepatitis C seroconversion in hemodialysis: a prospective study. *Kidney Int* 1993; 44: 1322–1326

Received for publication: 21.9.10; Accepted in revised form: 28.9.10