

# Acute hepatitis B outbreak in a nursing home for the disabled in Türkiye

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## Abstract

**Background:** Although hepatitis B is vaccine-preventable, it remains a significant health problem. To the best of our knowledge, this is the first hepatitis B outbreak report from Türkiye.

**Aims:** To investigate the cause of hepatitis B outbreak in a nursing home for the disabled and make recommendations for prevention.

**Methods:** An outbreak of acute hepatitis B was declared in a nursing home for the disabled following the admission of 3 patients from the home in a hospital. Collaborative response was initiated with the Provincial Health Directorate through the Public Health Infectious Diseases Department. We began tracking the infection and monitoring active cases. Audits and controls were carried out to determine the source, establish protection and control measures, and prevent further transmission.

**Results:** Six of the 65 nursing home residents were diagnosed with acute hepatitis B. Four of them had diabetes and their blood glucose levels were monitored for at least 12 months. Two of the patients had received dental treatment in the last 6 months. The frequency of both variables, which may be an indication of the transmission route, was statistically significantly greater in the acute hepatitis B group. All the patients who could be sequenced were identified as genotype D. While 3 patients recovered fully, 2 were diagnosed with chronic hepatitis B and one died due to fulminant hepatitis.

**Conclusion:** Standard routine immunization should be implemented as a preventive measure for acute hepatitis B. Frequent supervision and training on hygiene practices and safety precautions should be conducted for care staff working in collective residential facilities.

Keywords: hepatitis, vaccine, immunization, prevention, disabled, nursing home, safety precaution, Türkiye

Citation: Şahin AM, Sayan M, Çetin S, Telli E, Uğur M, Aydın E, et al. Acute hepatitis B outbreak in a nursing home for the disabled in Türkiye. *East Mediterr Health J.* 2024;30(4):292–299. <https://doi.org/10.26719/2024.30.4.292>.

Received: 12/09/23; Accepted: 18/01/24

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## Introduction

Although hepatitis B is a vaccine-preventable disease, according to the World Health Organization (WHO), 240 million hepatitis B virus (HBV) infections and 780 000 deaths due to hepatitis B are reported every year (1). Seroprevalence varies according to geographic region, and Türkiye is in the low-to-moderate endemic group (2). Seroprevalence of hepatitis B is higher in the Eastern Anatolia Region of Türkiye and lower in the western regions. Mean seroprevalence is reported as 2–8% for the country (3–5).

Hepatitis B vaccine was included in the routine childhood vaccination scheme in Türkiye in 1998. This led to a decrease in the number of cases of acute hepatitis B (AHB); the disease has now, however, been seen more frequently among people in the older age groups (6). Clinical presentation ranges from asymptomatic infection to fulminant hepatitis. While many factors play a role in this broad clinical outlook, it is established that the infection is primarily asymptomatic in children

under one year old, and 30–80% symptomatic in the adult age group (2, 7).

In accordance with the WHO's 2030 goals, Türkiye has introduced hepatitis B prevention, immunization and awareness-raising activities (1, 8). However, despite the intensive measures initiated both in Türkiye and worldwide, there are difficulties in preventing the transmission of the disease, especially among high-risk groups. The virus is found in varying proportions in semen, saliva, cervical secretions and tears, but mainly in blood, and viability can be maintained for up to 7 days on fomites (9). At room temperature, it can remain stable for 3–4 weeks on surfaces, 4 hours at 60°C, 15 years at –20°C, and for at least 35 years at –70°C (10–12). Even in tiny amounts, it can be transmitted via secretions other than blood through skin tissue that has impaired integrity.

Transmission can occur, especially among children, in institutions that host people with developmental disabilities and in environments where there is long-term close personal contact (2). Nursing homes, dialysis

units and outpatient clinics are frequently implicated in out-of-hospital health care-related transmission of HBV. In particular, before 2000, hepatitis B outbreaks were reported in shared accommodation such as nursing homes, hospitals and prisons. The recent publication of a hepatitis B outbreak due to acupuncture suggests that outbreaks could occur during cosmetic procedures (13).

In our study, AHB cases diagnosed in a nursing home for the disabled were examined to identify possible transmission routes and to initiate treatment and follow-up. The analysis aimed to identify the risk factors for AHB outbreaks, with the goal of improving compliance with infection control measures in places where living spaces are shared. By addressing these risk factors, we aim to prevent new outbreaks and reach wider populations through vaccination programmes

## Methods

This case-control study was carried out between April and August 2021 after 3 patients diagnosed with HBV were admitted to our hospital from a nursing home for the disabled in a province in the Black Sea Region of Türkiye. After the diagnosis of these 3 cases over a relatively short period in an institution having only 65 residents, the possibility of an outbreak was considered and action was taken to address the situation. The staff of the home comprised 4 nurses and 27 other employees, who were also tested for HBV infection.

After contacting the Provincial Health Directorate, a collaborative study was conducted in cooperation with the infectious diseases department of the public health services. The study covered the 65 residents of the home. Contact tracing and active case detection were carried out during the investigation of the outbreak. Examination and control processes were employed to determine the source, implement proper protection and control measures, and prevent the occurrence of new cases.

The steps for outbreak analysis were systematically examined and applied (14). After the outbreak was detected, the case definition was constructed. Cases of AHB were detected systematically and information about them recorded. A hypothesis was developed for risky situations in terms of transmission. The hypotheses regarding the risk factors for AHB were evaluated using a basic form which we developed during the field work to gather demographic data and information on possible transmission routes. The relevant higher authority was informed about control, surveillance and prevention measures, and suggestions were made for managing these issues.

Pre-employment and annual examinations of the nursing home staff and routine inspection of all residents were conducted by the institution. Regular testing showed hepatitis B surface antigen (HBsAg), hepatitis B surface antibody (anti-HBs) and antibody against hepatitis C (anti-HCV). Demographic data on the residents, such as sex, age, education status, marital status and other illnesses, were recorded. Considering

the long incubation period, data on potential risk factors such as the admission date of the patient to the nursing home, suspicious sexual contact, hospitalization during the last 6 months, transfusion, dental intervention, intravenous drug use, surgical intervention, manicure/pedicure history, blood glucose monitoring, use of a razor, and nail cutting were recorded. The status of hepatitis B vaccination was evaluated.

Possible risk factors were assessed during visits to the nursing home and procedures that could facilitate/cause transmission were investigated. The residents were interviewed about routine daily procedures and risky behaviours. Newly diagnosed hepatitis B patients were invited for follow-up for one year. Vaccination against HBV was administered to those who were HBV seronegative.

We used Cobas e 601 (Roche Diagnostic, Mannheim, Germany) with an Elecsys reactive kit to study HBsAg, anti-HBs, IgM and IgG antibodies (anti-HBc-IgM, anti-HBc-IgG), hepatitis B envelope antigen (HBeAg), and hepatitis B envelope antibody (anti-HBe) via electrochemiluminescence immunoassay (ECLIA). Quantitative real-time polymerase chain reaction (PCR) was used to study HBV DNA using the artus HBV QS-RGQ kit on the QIASymphony platform (QIAGEN, Hilden, Germany). In addition, genotype/subgenotype analyses of HBV isolated from patients were carried out.

We used 2 different case definitions for AHB:

1. HbsAg-positive and anti-HBc-IgM-positive cases.
2. Previously HbsAg-negative cases who became HbsAg-positive within the last 6 months and had elevated alanine transaminase and aspartate aminotransferase.

These cases were considered patients within the outbreak.

HBsAg-negative residents, other than those with AHB and those with known chronic hepatitis B, were identified as the non-AHB group. Patients in the non-AHB group were included in the analysis as the control group.

Patients whose HBsAg positivity persisted for more than 6 months during their follow-up were defined as having chronic hepatitis B (2). These patients were not included in the control group. The staff working in the nursing home were not included in the control group either.

After 3 cases of AHB were detected in the same nursing home in a 55-day period, the first case of AHB, referred to as patient number 1 in our study, was defined as the index case.

The HBV genotype/subgenotype determination covered all known primary/compensatory resistance mutations, HBsAg protein, surface-(S) gene 111–227 aa. interval and HBV polymerase (*pol*) gene reverse transcriptase, RT region, 80–250 aa. The interval was analysed by sequencing (15).

For HBV *pol* gene amplification (742 bp), forward (F:5'-tcgtgaccttcaatt-3') and reverse (R:5'-cgttgacagact-

ttccaatcaatcaat-3') primers were used. Sequencing was performed on the ABI PRISM 3130 platform (Applied Biosystems, Waltham, Massachusetts) according to the manufacturer's recommendations. The sequences obtained were analysed using *Geno2pheno* software (Center of Advanced European Studies and Research, Bonn). After comparison, the HBV *pol* gene was analysed for amino acids, primary drug resistance and compensatory mutations at positions 80, 84, 85, 91, 169, 173, 180, 181, 184, 191, 194, 202, 204, 214, 215, 233, 236–238 and 250 of the RT cycle (16). In addition, amino acids at positions 121, 135, 137, 139–149, 151–153, 155–157, 161, 164, 172, 173, 175, 176, 182, and 193–196 of the S gene region overlapping with the HBV RT cycle were analysed for the presence of mutations (17).

For the descriptive statistics, mean and standard deviation were used to summarize the continuous variables, while number, frequency and proportion were used to summarize the categorical variables. The chi-squared test or Fisher's exact test were used as appropriate for comparing categorical variables. The association between exposure and AHB case status was measured in univariable analysis by calculating the odds ratio and 95% confidence interval. Statistical significance was taken as  $P < 0.05$ . Statistical analysis was performed using SPSS, version 26.0.

Ethical approval was obtained from the Ankara City Hospital No. 1 research ethics committee chairmanship, file number E1-22-2400.

## Results

We examined 65 nursing home residents. The mean age of the residents was 60 years; 56.9% ( $n = 37$ ) were males. Education level was documented: 27.7% ( $n = 18$ ) were illiterate, 52.3% ( $n = 34$ ) were primary school graduates, 6.2% ( $n = 4$ ) were secondary school graduates and 13.8% ( $n = 9$ ) were high school graduates. Six of the 65 residents had contracted AHB; mean age among these 6 patients was 66 years. One resident, who had a chronic hepatitis B infection, was being followed up. The remaining 58 were designated as the non-AHB control group. We determined that 47 residents did not have a protective anti-HBs titre, and hepatitis B vaccination was recommended for them.

No HbsAg positivity was detected in the hepatitis B screening of the nursing home staff. We found that 18 of the 31 employees (4 nurses, 27 other staff) had been vaccinated against hepatitis B.

After the admission to hospital of 3 AHB patients from the same nursing home for the disabled within a 55-day period, the presence of an outbreak was considered, and the necessary investigations were initiated. The first AHB case admitted from the nursing home was defined as the index case. Consequently, the necessary applications were made to the Provincial Health Directorate, a research commission including the public health unit was established and a visit was made to the nursing home. We examined the nursing home management records of employees and residents.

Prior to this outbreak, a resident had been identified as having chronic hepatitis B and was being followed up. This resident was not known to have shared a room or any property with any of the AHB cases. Screening for infectious diseases was carried out, however, there was no vaccination programme. The patients diagnosed with AHB had been in the nursing home for a long time, a minimum of 2 years, and they had never left the home.

While inspections and thorough follow-ups continued in the nursing home, AHB patient number 4 was identified. After the last AHB patient was identified, no new patients were detected during the one-year follow-up. A fulminant course was observed in one patient, who later died. While 3 patients showed complete recovery and antibody response, biopsy was carried out on 2 patients: they were diagnosed with chronic hepatitis B and oral antiviral treatment was initiated. Age, sex, comorbidity, HbsAg results in the last 6 months, HBV serological markers at admission, HBV DNA levels, and outcome at one-year follow-up of patients who developed AHB are shown in Table 1.

To investigate the risk factors for the development of AHB, measurement of blood glucose levels; hospitalization, parenteral treatment and dental treatment within the previous 6 months; and use of shared personal care materials were evaluated. Frequency of taking blood glucose measurements and dental treatment within the previous 6 months were significantly higher among residents in the AHB group ( $P < 0.05$ ). Sharing of personal items was more frequent in the AHB group, but this was not statistically significant (Table 2). History of transfusion or surgical intervention, family history of HBV infection, suspicious sexual contact, and history of acupuncture were investigated as possible transmission routes but were not detected in any of the residents. We were informed that each resident had their own nail scissors and only disposable razors were used and we observed this equipment during the nursing home visits. However, during the interviews with staff and residents, we learned that, in practice, the same nail scissors were often used among the residents.

The virus was identified as genotype D in HBV isolated from the patients with AHB and in all samples with successful sequencing (Table 3). Patients 2 and 6 were identified as subgenotype D3, and patient number 5 was subgenotype D1. Only in patient number 5 were the *pol* gene, primary drug resistance mutations in the RT domain rtA181T and rtM204I and compensatory mutations rtL91I, rtV214A, and rtQ215P detected. In the same patient, various HBsAg leak mutations, sT131S (HBIG leak), sW172\*L (associated with rtA181T), sS193L (natural vaccine leakage), and sW196L (vaccine leakage) were detected together in the S gene region and coinciding with the RT domain (Table 3).

## Discussion

Our findings show that the 6 AHB cases identified consecutively in the nursing home for the disabled were

**Table 1** Distribution of laboratory data for disabled residents of a nursing home who developed acute hepatitis B, Türkiye, 2021

Characteristic	Patient no.					
	1	2	3	4	5	6
Age/sex	90/F	89/F	76/F	55/F	42/F	44/M
Additional diseases	HT, dementia	DM	HT, dementia	DM, psychosis	DM, psychosis	DM, psychosis
HBsAg in last 6 months	-	-	-	-	-	-
HBsAg	+	+	+	+	+	+
anti-HBc IgM	-	-	+	+	+	-
HBeAg	-	+	+	-	-	+
anti-HBe	-	-	-	+	+	-
anti-HBc IgG	+	+	+	+	+	+
anti-HBs	-	-	-	-	-	-
HBV DNA	3.21+E5	3.1+E8	1.6+E6	1.2+E4	>2.0+E7	3.0+E2
Clinic outcome	AHB exitus	Chronic HB	Recovery	Recovery	Recovery	Chronic HB

F = female, M = male, HT = hypertension, DM = diabetes mellitus, AHB = acute hepatitis B, HB = hepatitis B.

AHB outbreak-related. Few data exist on AHB outbreaks in Türkiye. In a seroepidemiological study conducted in 3 different care homes for the elderly in Italy in the early 1980s, cohabitation with an asymptomatic HBsAg-positive case may have caused the transmission, however, no single route could be identified (18). Analysis of a hepatitis B outbreak in a nursing home for the elderly by Sugauchi et al. did not identify a clear source for the outbreak. However, being elderly is a risk factor that makes a person more vulnerable to hepatitis B (19). The mean age of AHB patients in our study was 66 years, and some had mental disabilities. They may not have been aware of the transmission routes, a factor which can be considered as increasing the risk of transmission.

Measurement of blood glucose levels is a significant risk factor for hepatitis B outbreaks. In 1992, in the United States of America (USA), an outbreak of hepatitis B associated with contaminated devices used in measuring blood glucose was reported in a hospital for veterans (20). In the 2000s, in hepatitis B outbreaks detected in elderly care homes in Belgium, the USA and England, similar devices were blamed as possible means of transmission. Deficiencies in patient care procedures were emphasized; the lack of training of nursing home staff was mentioned, and despite the use of disposable devices, transmission

still posed a threat because the virus could maintain its viability on the device surface for an extended period (21–24). In a study of hepatitis B outbreaks in the USA between 1990 and 2000, it was found that disposable finger stick devices were used for more than one patient and that the glucose measuring device was not cleaned and disinfected before being used for the next patient (25). In our study, 4 of the AHB patients had diabetes, and blood glucose monitoring was being performed. This was statistically significant vis-à-vis possible transmission routes ( $P < 0.05$ ). The education status of most of the staff caring for patients was primary level only and they had been recruited from the village where the nursing home was located. The short courses that these care workers had attended were considered inadequate for learning and implementing infection control measures.

In a meta-analysis of 30 articles on a hepatitis B outbreak from Europe and the USA between 1992 and 2007, AHB was most commonly seen in dialysis units (30%), followed by nosocomial outbreaks and nursing home outbreaks (both 21%). The most common source of transmission was identified as the administration of drugs via multiple-use vials (30%). The second most common route was use of a nondisposable device during blood glucose measurements (27%) (26). In our

**Table 2** Risk factors for the development of acute hepatitis B identified among disabled residents of a nursing home in Türkiye, 2021

Risk factor	AHB group (n = 6) No. (%)	Non-AHB group (n = 58) No. (%)	P-value	Odds ratio (95% CI)
Blood glucose monitoring	4 (66.7)	11 (18.9)	0.023	6.53 (1.32–32.2)
Dental treatment in last 6 months	2 (33.3)	0 (0.0)	0.007	15.50 (6.0–39.99)
Use of shared personal care items	3 (50)	9 (15.5)	0.074	4.33 (0.99–18.88)
Hospital admissions in last 6 months	0 (0.0)	11 (18.9)	0.579	-
Parenteral treatment in last 6 months	0 (0.0)	10 (17.2)	0.578	-

CI = confidence interval.

**Table 3 Molecular analysis of hepatitis B virus in acute hepatitis B cases among disabled residents of a nursing home in Türkiye, 2021**

Patient no.	Age (years)/ sex	HBV genotype/ subtype	pol gene RT mutations	S gene mutations	HBV DNA load (IU/mL)
1	90/F	Unidentified			
2	89/F	D/D3	ND	ND	3.1+E8
2 <sup>a</sup>		D/D3	ND	ND	
3	76/F	Unidentified			1.6+E6
4	55/F	Unidentified			1.2+E4
5	42/F	Unidentified			>2.0+E7
5 <sup>a</sup>		D/D1	rtL91I, rtA181T, rtM204I, rtV214A, rtQ215P	sT131S, sW172 <sup>b</sup> L, sS193L, sW196L	
6	44/M	D/D3	ND	ND	

F = female, M = male, pol = polymerase, RT = reverse transcriptase, S = surface antigen, ND = analysed but not detected, Unidentified = DNA sequencing not successful.

<sup>a</sup>Sequence analysis of the same patient performed for the second time.

<sup>b</sup>Stop codon.

study, we asked nursing home residents about possible transmission routes: intravenous drug use, surgical intervention, dental intervention, transfusion history, suspected sexual contact, ordinary nail scissors and razors were considered. We found that 2 of the 6 patients who had AHB had received dental treatment within the previous 6 months, and this was statistically significant ( $P < 0.05$ ).

Although everyone was reported as having their own nail scissors, which was also observed on site, 12 of the residents recalled using shared nail scissors occasionally. These instances were not, however, statistically significant ( $P > 0.05$ ).

Routine screening tests of the nursing home employees showed no HBsAg positivity and all 4 nurses as well as 14 of the 27 staff members were vaccinated against hepatitis B. In the routine screening of the residents before they were admitted to the nursing home, HBsAg and anti-HBs values had been examined in accordance with standard procedures. This high-risk group, who lived communally, and many of whom were mentally disabled, had not been vaccinated against hepatitis B and there was no routine vaccination programme for them. The fact that vaccination against hepatitis B was left to the discretion of the institution was considered a significant deficiency.

It has been established that HBV has a high replication capacity ( $> 10^{12}$  virions/day) and a high frequency of mutation due to the inability to correct errors during the reverse transcription process ( $10^{-5}$  substitution/base/cycle) (27, 28). Thus, each nucleotide in the HBV genome can change over a day and various mutations can occur. In the genome organization of the virus, the pol and S genes overlap (28, 29). Thus, drug resistance mutations can cause amino acid changes in the structure of HBsAg. In our study, naturally occurring nucleoside primary drug resistance mutations (rtA181T, rtM204I) were

detected in one patient identified as having AHB. At the same time, this case showed compensatory mutations (rtL91I, rtV214A, rtQ215P) to repair HBV replication. A number of natural HBsAg leak mutations (sT131S, sW172<sup>a</sup>L, sS193L, sW196L) were detected in the S gene region that overlapped with the RT domain (Table 3). These mutations, which are HBsAg leaks, may need to be carefully monitored epidemiologically.

The fact that the hepatitis B results of 58 nursing home residents who were not diagnosed with AHB were examined for routine screening purposes only and that the necessary permissions for anti-HBc-IgG results could not be obtained were determined as restrictive features.

In line with the elimination goals of the WHO, Türkiye implements certain anti-hepatitis interventions, including regular neonatal hepatitis B vaccination. Populations living in collective shelters, especially elderly and disabled populations, where percutaneous and horizontal transmission are seen excessively, should be considered a distinct group. The examinations requested prior to admission to an institution should be regarded as more than just routine exercises of the institution but as essential measures for the protection of its employees and clients. There should be clear procedures for vaccinating the vulnerable group, the actual residents of such institutions. During our study, the officials and employees of the nursing home were contacted and provided with information, and routine hepatitis B vaccination was administered to seronegative patients. However, for this disease, which can only be prevented by immunization, it is necessary to routinely observe standard vaccination procedures. In addition, frequent supervision of the care staff is necessary and intermittent training on hygiene and patient care procedures should be provided.

**Funding:** None.

**Competing interests:** None declared.

## Flambée d'hépatite B aiguë dans une maison de retraite pour personnes handicapées en Türkiye

### Résumé

**Contexte :** Bien que l'hépatite B soit évitable par la vaccination, elle reste un problème de santé important. À notre connaissance, il s'agit du premier rapport concernant une flambée d'hépatite B en Türkiye.

**Objectifs :** Étudier les causes de la flambée d'hépatite B dans une maison de retraite pour personnes handicapées et formuler des recommandations en matière de prévention.

**Méthodes :** Une flambée d'hépatite B aiguë a été déclarée dans une maison de retraite pour personnes handicapées à la suite de l'hospitalisation de trois patients venant de cet établissement. Une réponse concertée a été mise en place avec la Direction provinciale de la santé par l'intermédiaire du Département de la santé publique pour les maladies infectieuses. Nous avons commencé à effectuer un suivi de l'infection et à surveiller les cas actifs. Des audits et des vérifications ont été menés pour déterminer la source, mettre en place des mesures de protection et de contrôle et prévenir toute transmission ultérieure.

**Résultats :** Six des 65 résidents de la maison de retraite ont été diagnostiqués avec une hépatite B aiguë. Quatre d'entre eux souffraient de diabète et leur taux de glycémie a été surveillé pendant 12 mois au minimum. Deux des patients avaient reçu des soins dentaires au cours des six derniers mois. La fréquence de ces deux variables, qui peut être une indication de la voie de transmission, était plus élevée de manière statistiquement significative dans le groupe de patients atteints d'hépatite B aiguë. Tous les patients ayant pu faire l'objet d'un séquençage ont été identifiés comme étant porteurs du génotype D. Alors que trois patients se sont complètement rétablis, deux ont été diagnostiqués avec une hépatite B chronique et un est décédé en raison d'une hépatite fulminante.

**Conclusion :** La vaccination systématique standard devrait être mise en œuvre en tant que mesure de prévention de l'hépatite B aiguë. Le personnel soignant qui travaille dans des établissements résidentiels collectifs devrait être fréquemment supervisé et formé aux pratiques d'hygiène et aux précautions de sécurité.

### فاشية التهاب الكبد B الحاد في دار لرعاية المعوقين في تركيا

أحمد مليح شاهين، مراد سايان، سنان جيبين، أينس التلي، مديحة أوغور، أمسال أيدين، إلكنور شينيل، أونال أوزيك، ميلتم أرزو يتكين

### الخلاصة

**الخلفية:** على الرغم من أن التهاب الكبد B مرض يمكن الوقاية منه باللقاحات، فإنه لا يزال يمثل مشكلة صحية كبيرة. وعلى حد علمنا، هذا هو أول تقرير عن فاشية التهاب الكبد B في تركيا.

**الأهداف:** هدفت هذه الدراسة إلى تحري سبب فاشية التهاب الكبد B في دار لرعاية المعوقين، وتقديم توصيات للوقاية منها.

**طرق البحث:** أُعلن عن تفشي التهاب الكبد الحاد B في دار لرعاية المعوقين، بعد دخول 3 مرضى من المقيمين في الدار إلى المستشفى. وبدأت الاستجابة التعاونية من مديرية الصحة في المقاطعات عبر إدارة الأمراض المعدية في مجال الصحة العامة. ولقد بدأنا تتبع العدوى ورصد الحالات النشطة، وأجريت مراجعات وضوابط من أجل تحديد المصدر، ووضع تدابير للحماية والمراقبة، ومنع استمرار انتقال العدوى.

**النتائج:** سُخِّصت إصابة ستة من 65 نزلاء دار الرعاية بالتهاب الكبد B الحاد، منهم أربعة مصابون بالسكري، وجرت متابعة مستويات السكر في الدم لديهم 12 شهرًا على الأقل. وكان اثنان من المرضى قد تلقوا علاج الأسنان في الأشهر الستة الأخيرة. وفي حين أن تواتر كلا المتغيرين قد يكون مؤشرًا على مسار انتقال العدوى، فإنه قد كان أكبر كثيرًا من الناحية الإحصائية في مجموعة التهاب الكبد B الحاد. وحُدِّد جميع المرضى الذين يمكن إجراء تسلسل لهم على أنهم من النمط الجيني D. وفي حين تعافى 3 مرضى تمامًا، سُخِّصت حالة اثنين منهم بالتهاب الكبد B المزمن، وتوفي واحد منهم بسبب التهاب الكبد الحاد.

**الاستنتاجات:** ينبغي تنفيذ التحصين الروتيني المعياري بوصفه تدبيرًا وقائيًا من التهاب الكبد B الحاد. وينبغي الإشراف والتدريب باستمرار على ممارسات النظافة الشخصية واحتياطات السلامة لموظفي الرعاية العاملين في المرافق السكنية الجماعية.

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