Sudden Deaths of Croatian Hemodialysis Patients in October 2001

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In 2001, there were 2,719 patients with chronic renal failure dialyzed in Croatia. Death rate in this patient group was 10.3%, similar to that in other countries. On October 12, 2001, the Croatian Institute of Public Health received information that four patients unexpectedly died in the dialysis center in Požega General Hospital in a single day. Within a week, a total of 23 dialysis patients died in Croatia, of whom 5 during hemodialysis, and 18 within several hours after hemodialysis. Those events prompted us to assess the epidemiological situation in all hemodialysis centers in Croatia. We used phone contacts and reports of regional centers to collect the data. Clinical picture of the patients before death was characterized by dyspnea, hypotension, and cardiac arrest; resuscitation was unsuccessful in all cases. Analysis of all possible risk elements associated with hemodialysis revealed that dialysis devices, dialyzate, water, and personnel were different in all cases, and that the only common denominator in all events was dialyzer P-15 or P-18, manufactured by Baxter, USA, and distributed by Pliva, Croatia.

Key words: Croatia; fluorocarbons; membranes, artificial; renal dialysis; Spain; sudden death; USA

Sudden death in dialysis patients is mainly a consequence of a cardiovascular event. It rarely occurs during the extracorporeal procedure itself (1,2). Reactions to hemodialysis are usually allergic, occurring mainly at the beginning of hemodialysis (3). Most allergic reactions are caused by a foreign substance, and as a rule do not have a lethal outcome (4,5). The problems encountered in dialysis units in Croatia were not different from those mentioned above, except for the increased frequency of B and C hepatitis in dialyzed patients, which is a specificity of our setting (6). End-stage renal failure is mainly managed by chronic intermittent dialysis in dialysis centers, usually located in hospitals. Home hemodialysis in Croatia is rudimentary (only six patients). According to the Institute of Public Health annual report 2000, 2,719 patients with chronic renal failure were dialyzed in Croatia. Of these, 143 were on peritoneal dialysis, whereas the majority were on hemodialysis. Death rate was 10.3% (7), similar to the rate in other countries in the world.

Information about four deaths that occurred in single day, on October 12, 2001, in the Hemodialysis Center in Požega General Hospital, pointed to the gravity and tragedy of the events to follow. When the connection with dialysis centers throughout Croatia was established, we learned that there were 24 fatal events, most of which were unexpected. Immediately after first epidemiological data were received, we started to investigate the possible causes and found that the only common factor was a dialyzer manufactured by Baxter Inc. (Deerfield, IL, USA) for the local distributor, Pliva Inc. (Zagreb, Croatia).

Patients and Methods

In a single week, 24 patients died in seven hemodialysis centers in Croatia. All patients had been on hemodialysis between two and 245 months because of chronic renal failure. We analyzed the reports of the regional dialysis centers that were sent to the Ministry of Health. Among the reported cases, one patient committed suicide and thus did not fall into the investigated group. This patient was dialyzed on hemofane membrane. Other 23 patients were dialyzed in six different centers throughout Croatia (Zagreb, Požega, Karlovac, Rijeka, Dubrovnik, and Pula) on cellulose diacetate membranes P-15 (15 patients) or P-18 (8 patients) (Figs. 1 and 2). All preserved incriminated P-15 dialyzers had the same batch number – 2001 F 07 P (11 devices), and most of P-18 dialyzers had the same batch number – 2001 B 17 R. All the dialyzers on which the events occurred were manufactured by Baxter and distributed by Pliva. Some of the incriminated P-15 and P-18 dialyzers were flushed out with the dialysis solution and the differences between them and the same type of dialyzers with different batch number were determined by gas chromatography.

The quality of water in all dialysis centers was analyzed by measuring conductivity and was found satisfactory (Table 1).

Some of the patients were autopsied (Table 2) and their blood was taken for chemical and toxicological analysis. However, the results of chemical and toxicological analysis are still not conclusive.
Results

Course of Events

In the evening of Friday, October 12, 2001, the epidemiological service of the Croatian Institute of Public Health and the Ministry of Health received the first report on deaths of patients on dialysis from the dialysis center in Požega General Hospital, where four dialysis patients unexpectedly died on that same day. The same evening, information arrived about five more deaths in Dialysis Center at the Department of Urology, Zagreb University Hospital Center, which had occurred before October 12 – two patients had died on October 8, one after and one during hemodialysis, two more on the next day, on October 9, and one on October 11. That night, the Ministry of Health formed a committee to investigate the events in these institutions. On Saturday morning, October 13, the committee contacted by phone all dialysis centers in the Republic of Croatia to inquire if there had been other deaths and to give concrete instructions derived from the insight gained thus far, ie, to put out of use Baxter’s P-15 and P-18 dialyzers. On Monday, October 15, all dialysis centers received a questionnaire, which they had to fill out and return immediately to the Ministry of Health (Tables 1 and 2; Figs. 1 and 2).

Deaths

The clinical picture was similar in all the deceased patients. It was characterized by feeling of Table 1. Consumables used on dialysis, data on purity of water, and disinfection of the devices for 23 Croatian hemodialysis (HD) patients who died in October 2001

<table>
<thead>
<tr>
<th>Patient</th>
<th>HD apparatus</th>
<th>Dialyzer*</th>
<th>Bicarbonate capsule</th>
<th>Solutions for HD</th>
<th>AV line</th>
<th>Needles</th>
<th>Electrical conductivity (microsiemens)</th>
<th>Disinfection of device</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Althin Tina 1000</td>
<td>P-15 2001F07P</td>
<td>Plivakart 750 g</td>
<td>HKDM 11 Pliva</td>
<td>Althin DW 480</td>
<td>Kamasuki</td>
<td>5-6</td>
<td>Tintol, citric acid</td>
</tr>
<tr>
<td>2</td>
<td>Althin Altratonek 1000</td>
<td>P-15 2001F07P</td>
<td>Plivakart 750 g</td>
<td>HKDM 11 Pliva</td>
<td>Althin DW 480</td>
<td>Kamasuki</td>
<td>5-6</td>
<td>Tintol, citric acid</td>
</tr>
<tr>
<td>3</td>
<td>Althin Tina</td>
<td>P-15 2001F07P</td>
<td>Plivakart 750 g</td>
<td>HKDM 11 Pliva</td>
<td>Althin DW 480</td>
<td>Kamasuki</td>
<td>5-6</td>
<td>Tintol, citric acid</td>
</tr>
<tr>
<td>4</td>
<td>Althin Tina</td>
<td>P-15 2001F07P</td>
<td>Plivakart 750 g</td>
<td>HKDM 11 Pliva</td>
<td>Althin DW 480</td>
<td>Kamasuki</td>
<td>5-6</td>
<td>Tintol, citric acid</td>
</tr>
<tr>
<td>5</td>
<td>Braun Dialog</td>
<td>P-15*</td>
<td>Braun Solcard</td>
<td>SW380A Braun</td>
<td>Althin DW 480</td>
<td>Kamasuki</td>
<td>5-6</td>
<td>Tintol, citric acid</td>
</tr>
<tr>
<td>6</td>
<td>Althin Altratonek 1000*</td>
<td>Braun Solcard</td>
<td>HKDM 14</td>
<td>Althin 340-04-0</td>
<td>Nipro</td>
<td>10-13</td>
<td>50% citric acid</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Althin 1000</td>
<td>P-15*</td>
<td>Braun Solcard</td>
<td>HKDM 14</td>
<td>Althin 340-04-0</td>
<td>Nipro</td>
<td>10-13</td>
<td>50% citric acid</td>
</tr>
<tr>
<td>8</td>
<td>Hospal Integra P-15*</td>
<td>Braun Solcard</td>
<td>HKDM 14</td>
<td>Hospal A70/HINT/CAC95</td>
<td>Nipro</td>
<td>10-13</td>
<td>50% citric acid</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Hospal Integra P-15*</td>
<td>Plivakart*</td>
<td>HKDM 14 Pliva*</td>
<td>Hospal Hemoline A70/V72</td>
<td>Mediplast</td>
<td>1</td>
<td>Dialox, Plivascept</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Hospal Integra P-18*</td>
<td>Plivakart*</td>
<td>HKDM 14 Pliva*</td>
<td>Hospal Hemoline A70/V72</td>
<td>Mediplast</td>
<td>1</td>
<td>Dialox, Plivascept</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Hospal Integra P-18*</td>
<td>Plivakart*</td>
<td>HKDM 14 Pliva*</td>
<td>Hospal Hemoline A70/V72</td>
<td>Mediplast</td>
<td>1</td>
<td>Dialox, Plivascept</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Fresenius 2008 E</td>
<td>P-18*</td>
<td>Plivakart 750 g</td>
<td>HKDM 12 Pliva</td>
<td>Althin Serallo</td>
<td>Mediplast</td>
<td>1</td>
<td>Dialox</td>
</tr>
<tr>
<td>13</td>
<td>Fresenius 2008 E</td>
<td>P-18*</td>
<td>Plivakart 750 g</td>
<td>HKDM 12 Pliva</td>
<td>Althin Serallo</td>
<td>Mediplast</td>
<td>1</td>
<td>Dialox</td>
</tr>
<tr>
<td>14</td>
<td>Fresenius P-18*</td>
<td>Plivakart 750 g</td>
<td>HKDM 12 Pliva</td>
<td>Althin Serallo</td>
<td>Mediplast</td>
<td>1</td>
<td>Dialox</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Althin Tina</td>
<td>P-18*</td>
<td>HKDM 11</td>
<td>Althin Serallo</td>
<td>Mediplast</td>
<td>1</td>
<td>Dialox</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Althin Tina</td>
<td>P-18*</td>
<td>HKDM 11</td>
<td>Althin Serallo</td>
<td>Mediplast</td>
<td>1</td>
<td>Dialox</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Fresenius 4000 E</td>
<td>P-18*</td>
<td>HKDM 12 Pliva</td>
<td>Althin Serallo</td>
<td>Mediplast</td>
<td>1</td>
<td>Dialox</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Fresenius 4000 E</td>
<td>P-18*</td>
<td>HKDM 12 Pliva</td>
<td>Althin Serallo</td>
<td>Mediplast</td>
<td>1</td>
<td>Dialox</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Fresenius 2008 C</td>
<td>P-18*</td>
<td>HKDM 12 Pliva</td>
<td>Althin Serallo</td>
<td>Mediplast</td>
<td>1</td>
<td>Dialox</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Fresenius 2008 C</td>
<td>P-18*</td>
<td>HKDM 12 Pliva</td>
<td>Althin Serallo</td>
<td>Mediplast</td>
<td>1</td>
<td>Dialox</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Hospal Integra P-15 F07P</td>
<td>P-15 F07P</td>
<td>HKDM 14 Pliva</td>
<td>Hospal Hemoline A70/V72</td>
<td>Medical</td>
<td>10</td>
<td>Instanet Hospal</td>
<td></td>
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<tr>
<td>22</td>
<td>Fresenius 4000 E</td>
<td>P-15 F07P</td>
<td>HKDM 12 Pliva</td>
<td>Helios Medical</td>
<td>10</td>
<td>Dialox</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Fresenius 4000 E</td>
<td>P-15 F07P</td>
<td>HKDM 12 Pliva</td>
<td>Helios Medical</td>
<td>10</td>
<td>Dialox</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*All dialyzers manufactured by Baxter, USA, and distributed by Pliva. Asterisk indicates dialyzers whose control number has not been preserved.
pressure and pain in the chest. Suffocation, chest pain, sweating, and in some cases (two patients) generalized convulsions predominated. The deaths occurred suddenly either after two hours on hemodialysis or within the first several hours upon the completion of dialysis. Dyspnea and restlessness lasted briefly, most often about half an hour from the beginning of symptoms until the cardiac arrest. All events had lethal outcome, despite resuscitation attempts in hospital settings. Some patients went home with no discomfort, and according to information obtained from the families, their manner of death corresponded to those seen in the hospitals.

A patient with metastatic uterine cancer and ascites went home upon completion of dialysis and died 5 h after the beginning of dialysis. According to the information received by phone from a physician in the Dialysis Center in Rijeka, her death was not immediately expected despite the grave diagnosis, because she was ambulatory and her health condition was satisfactory. Another patient had suffered a coronary event (thrombosis of the AV fistula) eight days before the dialysis and was treated in hospital. Dialysis was performed on a P-18 dialyzer and was uneventful, as in the former patient. Death occurred 37 h after the dialysis. In these two cases, death could not be with certainty associated with the dialyzer (Table 1, Fig. 2). All other patients on chronic hemodialysis (21 patients) died unexpectedly and the only common factor was the dialyzer. All other materials analyzed – water, dialysis solutions, AV lines, needles – were different, as well as the staff. The conviction that

Figure 2. Lethal outcomes in chronic renal failure patients on hemodialysis who died between October 8 and October 13, 2001, in Croatia.

Table 2. Clinical data on sudden death of hemodialysis (HD) patients in Croatia, October 2001

<table>
<thead>
<tr>
<th>Patient</th>
<th>No. sex age</th>
<th>Town</th>
<th>Diagnosis</th>
<th>Duration of HD (months)</th>
<th>Date of incident (October)</th>
<th>Hours from beginning of HD to incident</th>
<th>Incident on HD</th>
<th>Clinical picture</th>
<th>Main autopsy finding</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 F 69 Požega</td>
<td>CRI, chronic pyelonephritis</td>
<td>19</td>
<td>12</td>
<td>5.3</td>
<td>after</td>
<td>cardiorespiratory arrest</td>
<td>thick red foam in cardiac chambers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 F 26 Požega</td>
<td>CRI, GN</td>
<td>125</td>
<td>12</td>
<td>5.14</td>
<td>after</td>
<td>arrest</td>
<td>light red foam in right heart, dard red foam in left heart</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 M 78 Požega</td>
<td>CRI, chronic pyelonephritis</td>
<td>52</td>
<td>12</td>
<td>4.35</td>
<td>after</td>
<td>arrest</td>
<td>foamed blood in conus pulmonaryis and right heart</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 F 40 Požega</td>
<td>CRI, GN</td>
<td>147</td>
<td>12</td>
<td>2.25</td>
<td>during</td>
<td>arrest</td>
<td>pulmonary edema, cardiac</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 M 60 Zagreb</td>
<td>CRI, arterial hypertension</td>
<td>88</td>
<td>8</td>
<td>7</td>
<td>after</td>
<td>dyspnea, chest pain, arrest</td>
<td>pulmonary edema, cardiac</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 F 63 Zagreb</td>
<td>CRI, chr. pyelonephritis, Hepatitis C</td>
<td>122</td>
<td>8</td>
<td>4</td>
<td>during</td>
<td>fall of blood pressure, cerebral convulsions</td>
<td>pulmonary edema, cardiac</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 M 71 Zagreb</td>
<td>CRI, chronic pyelonephritis</td>
<td>113</td>
<td>9</td>
<td>2.25</td>
<td>during</td>
<td>hypotension, loss of consciousness</td>
<td>pulmonary edema, cardiac</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 M 66 Zagreb</td>
<td>CRI, diabetes mellitus</td>
<td>13</td>
<td>9</td>
<td>5.3</td>
<td>after</td>
<td>arrest</td>
<td>left coronary artery occlusion, right cor. art. occlusion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 M 24 Zagreb</td>
<td>CRI, arterial hypertension</td>
<td>11</td>
<td>10</td>
<td>2.45</td>
<td>during</td>
<td>arrest</td>
<td>foamed blood in pulmonary artery and l. carotid art.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 F 42 Kvarner</td>
<td>CRI, arterial hypertension</td>
<td>80</td>
<td>10</td>
<td>12</td>
<td>after</td>
<td>suffocation, chest oppression, arrest</td>
<td>pulmonary edema, cardiac</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 F 65 Kvarner</td>
<td>CRI, polycystosis</td>
<td>189</td>
<td>12</td>
<td>13.25</td>
<td>after</td>
<td>suffocation, chest pain arrest</td>
<td>pulmonary edema, cardiac</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 F 52 Kvarner</td>
<td>CRI, GN, Hepatitis C and B</td>
<td>245</td>
<td>10</td>
<td>9</td>
<td>after</td>
<td>chest pain, arrest</td>
<td>pulmonary edema, cardiac</td>
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<tr>
<td>13 M 21 Rijeka</td>
<td>CRI, chronic pyelonephritis</td>
<td>108</td>
<td>10</td>
<td>2.30</td>
<td>during</td>
<td>dyspnea, chest pain</td>
<td>foamed blood in the right heart</td>
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<tr>
<td>14 F 75 Rijeka</td>
<td>CRI, chronic pyelonephritis + E17</td>
<td>88</td>
<td>10</td>
<td>5.3</td>
<td>after</td>
<td>pain in lower abdomen</td>
<td>foamed blood in the right heart</td>
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<tr>
<td>15 M 63 Dubrovnik</td>
<td>CRI, diabetes mellitus</td>
<td>118</td>
<td>10</td>
<td>4.15</td>
<td>after</td>
<td>coma</td>
<td>foamed blood in the right heart</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16 M 63 Dubrovnik</td>
<td>CRI, endocrine nephropathy</td>
<td>62</td>
<td>8</td>
<td>4.2</td>
<td>after</td>
<td>chest pain, sweating, arrest</td>
<td>foamed blood in the right heart</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18 M 29 Pula</td>
<td>CRI, GN</td>
<td>86</td>
<td>13</td>
<td>7.25</td>
<td>after</td>
<td>arrest</td>
<td>foamed blood in the right heart</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19 F 32 Pula</td>
<td>CRI, SLE</td>
<td>79</td>
<td>13</td>
<td>11.15</td>
<td>after</td>
<td>dyspnea, arrest</td>
<td>foamed blood in the right heart</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20 F 30 Pula</td>
<td>CRI, SLE</td>
<td>92</td>
<td>13</td>
<td>4.35</td>
<td>after</td>
<td>arrest</td>
<td>foamed blood in the right heart</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21 F 68 Pula</td>
<td>CRI, diabetes mellitus</td>
<td>43</td>
<td>13</td>
<td>4.55</td>
<td>after</td>
<td>progressive deterioration of general condition</td>
<td>foamed blood in the right heart</td>
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<td></td>
</tr>
<tr>
<td>22 F 70 Pula</td>
<td>CRI, diabetes mellitus</td>
<td>2</td>
<td>13</td>
<td>7.05</td>
<td>after</td>
<td>dyspnea, arrest</td>
<td>foamed blood in the right heart</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23 M 65 Pula</td>
<td>CRI, polycystosis</td>
<td>99</td>
<td>13</td>
<td>5.25</td>
<td>after</td>
<td>arrest</td>
<td>foamed blood in the right heart</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1 CRI - chronic renal insufficiency; CR-glomerulonephritis; SLE - systemic lupus erythematosus.
2 EPI - epileptic seizures; AM - acute myocardial infarction.
deaths had been caused by the dialyzer was addition-
ally strengthened by the fact that in five patients death
occurred during dialysis, in 16 patients within 10 h af-
after the beginning of dialysis, and only in two patients
after more than 10 hours. In autopsied patients, in ad-
tion to findings common in chronic end-stage renal
failure, foamed blood was found in the heart cham-
bers, which were also dilated.

Flow of Information

Information about those first dialysis deaths in
Croatia (two in Zagreb and two in Dubrovnik), which
occurred on October 8, 2001, was initially recorded
in respective centers for dialysis. At first, no technical
problem was suspected because hemodialysis pa-
tients have higher death rate than general population.
First systematic data collection began in the evening
of Friday, October 12, after the Institute of Public
Health and the Ministry of Health had received the re-
port from Požega General Hospital (Fig. 1). The next
morning, October 13, all dialysis centers in Croatia
and the distributor of dialyzers were contacted, as
well as the manufacturer, since brief information was
found on the Internet about earlier fatal events in
some of the patients dialyzed on Baxter’s dialyzers in
886.asp). Data on all events in all Croatian centers
were gathered and information was exchanged.

Analysis

Analysis of all elements relevant to the process of
extracorporeal circulation on hemodialysis was per-
formed to find the common denominator in all
events. Table 1 shows data on used devices, type of
bicarbonate capsules, hemodialysis solutions, AV
lines, needles, and disinfectants of devices. The water
did not show any impurity, and conductivity values
ranged from 0 to 10.1 microsiemens. Examination of
the concentrate matched the declaration on the solu-
tion label. Autopsy findings (Table 2) revealed that
the heart chambers of the patients were dilated and
blood was foamed. At an autopsy in Požega, when
the heart of one patient was cut open under water, co-
pious air bubbles were released from the heart. Sam-
plles of the fluid flushed through the incriminated
P-15 dialyzers, batch number 2001 F07 P, produced a
different pattern (different peak) on gas chromatog-
raphy than control cellulose diacetate dialyzers that
were produced by the same manufacturer but carried
a different batch number (data not shown).

Discussion

As stated previously, deaths in patients on dialy-
sis are most often a consequence of cardiovascular
events, and rarely occur during the dialysis procedure
itself. Fatal outcomes are mostly unrelated to any of
the elements of extracorporeal circulation. Available
reports mainly mention allergic manifestations during
hemodialysis. According to current data, allergic
problems are caused by cellulose acetate membrane
dialyzers stored for longer periods of time, and are
characterized by eye redness and tears, loss of hear-
ing, tinnitus, and bone pain (1-5).

Mortality of patients on hemodialysis in the world
is between 9% and 10%, and the rate in Croatia does
not substantially differ from this average (7). Accord-
ing to the annual report 2000, death rate in dialysis
patients in Croatia was 10.3%. Although the death
rate varies over the weeks, the events that occurred
during the week in October 2001 undoubtedly sug-
gested causes other then the common cardiovascular
or cerebrovascular diseases in hemodialysis patients.
The previous hemodialyses that the tragically de-
ceased patients had undergone were uneventful and
different as well as the staff, who had been working in
dialysis units for years. Sudden deaths in hemodialy-
sis patients in the brief period of only a few days
occurred on October 8, 2001, was initially recorded
at one day, the situation in other centers in Croatia was
checked. It was subsequently discovered that not one
but two types of dialyzers were involved, which addi-
tionally hindered the identification of the problem.
Collection of epidemiological data was impeded by
the fact that the events happened in a very short pe-
riod of time, as well as by insufficient communication
between the centers for dialysis. All elements – acute
onset of clinical picture, very similar clinical manifes-
tations, unsuccessful resuscitations, autopsy findings,
different consumables in dialysis procedure, with the
exception of cellulose diacetate membrane manufac-
tured by Baxter – pointed to the dialyzers as the cause
of the events. The exact mechanism of the event is
still unknown, but foamed blood in the hearts of some
patients suggests intravascular release of a substrate,
which caused sudden death. However, up until now,
there have been no reports at all on mechanisms of
similar events.
Recent finding by the manufacturer indicates that perfluorohydrocarbon, the fluid used for preparation and stabilization of fibers, could be associated with these events (11). The fluid is used in Baxter’s facility in Sweden for stabilization of fibers for dialyzers (12,13). After withdrawal of the incriminated dialyzers, no new dialysis deaths have been recorded in Croatia. Meticulous laboratory work is now needed to identify with certainty the substance(s) responsible for tragic outcomes.

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