Renal dialysis services in the Christchurch earthquakes of 2010–2011

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Abstract
At 12.51 pm on 22 February 2011, an earthquake with a magnitude of 6.3 hit Christchurch, New Zealand. The power, sewage and water infrastructure were seriously damaged across the city including damage to the Acute Dialysis Unit and Home Dialysis Training Centre. Most haemodialysis (HD) patients were evacuated to other cities, increased acute dialysis services were required and home peritoneal dialysis (PD) services required management. Our experience reinforces the need for renal units to:

• Undertake practice evacuation and emergency drills (presuming there will be no lifts).
• Check regularly that emergency torches work.
• Ensure hard-wired phones are installed within facilities and at home.
• Ensure each dialysis unit has an evacuation pack close to the exit which includes a battery radio and containing basic supplies to enable:
  • The removal of AVF cannula.
  • Flushing and locking of central venous catheters.
  • Drainage of intra-abdominal PD fluid.

Although it is impossible to plan in any detail for disasters of this magnitude, there are some disaster preparation activities, protocols and equipment that could be vital in the event of such a disaster.

Keywords
New Zealand, earthquake, renal, dialysis, nursing, disaster.

12.51 pm 22 February 2011
A magnitude 6.3 earthquake hit Christchurch with a ground acceleration believed to be the second highest ever recorded in the world and four times greater than Haiti. The quake far exceeded all Christchurch building codes. Although Christchurch was saved from even greater destruction because of the short 12-second duration, there were three major aftershocks within minutes. The effect to Christchurch was enormous, with 181 known people dead, 1,500 to 2,000 injuries, of which 164 were serious.

Christchurch central business district (CBD) was devastated, and is still cordoned off today (5 May 2011). The

Prelude: 4.36 am 4 September 2010
A magnitude 7.1 earthquake hit the South Island of New Zealand, resulting in two serious injuries, widespread damage to older buildings and disruption to the supply of water, power and sewage. There was minor damage and a short disruption of water and power to both Christchurch dialysis units; however, all affected patients were able to remain in Christchurch. Haemodialysis (HD) was provided in the two dialysis units, using multiple shifts over a seven-day week, gradually reducing as patients were able to return home over a two-week period. We thought we were getting back on track, but little did we know what lay in store.

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power, sewage and water infrastructure were seriously damaged across the city. Included in this was minor damage to the Acute Dialysis Unit (six HD stations) and major damage to the Home Dialysis Training Centre (nine HD/PD stations) with loss of power and water. This building was only three years old and unable to be used until 21 March, even though there remain ongoing repairs.

1 pm 22 February 2011
Confusion reigned with the hospital swinging into full emergency mode. Both dialysis units were evacuated via stairwells, with patients disconnected and taken off dialysis using emergency procedures. Patients and staff were kept together as a group, initially in the hospital foyer and later in Hagley Park opposite the hospital. Intravenous HD cannula (needles) were removed with peritoneal dialysis (PD) fluid drained using trees (those that were still standing). Communication was difficult with mobile networks overloaded and land line phones not working. Everyone (patients/staff) was concerned for the safety of friends and family.

5 pm 22 February 2011
All staff and patients were determined safe and most were on their way home with arrangements for as many staff as possible to meet in Hagley Park at 7.30 am the next day. However, getting home was not that simple. Roads were broken, liquefaction had occurred everywhere, buildings were destroyed, helicopters, sirens, rubble and smoke abounded. Traffic was deadlocked and cars were abandoned, with many walking home, some for several hours. To me it appeared something like a scene from a war movie except that it was real.

The renal team met to strategise urgent planning for the influx of acute renal failure patients as reports of collapsed buildings emerged. Most crush victims were stabilised and transferred to intensive care units (ICUs) around the country. Only one required dialysis in Christchurch and two received continuous therapy (CRRT). At this time we had already received multiple offers of help from the New Zealand, Australian and wider nephrology community.

7.30 am 23 February 2011
All medical and dialysis staff met in Hagley Park as arranged. The Acute Dialysis Unit could be occupied so an operations centre was established there.

8 am to 8.30 pm 23 February 2011
A decision was made to evacuate all HD patients in the affected area to Auckland. The National Emergency Coordination Centre advised and made arrangements for the RNZAF flight. All affected patients except one were contacted and told to be at the meeting point with one bag of clothes by 3.30 pm. Each patient was allowed one support person. There was no choice for these patients to remain in Christchurch. Two patients made their own arrangements to dialyse elsewhere, one in Dunedin and one at a friend's house in Hanmer Springs.

Dialysis staff contacted PD patients to ascertain their situation and advise them about heating bags, hygiene and other issues relating to power, water and sewage faults. Many patients with badly damaged homes and/or without power, water or sewage made arrangements to stay with family or friends.

HD patients (many diabetics) arrive at the meeting point in the airport hotel. No food was available anywhere in the hotel or vicinity. An urgent despatch of available food and drink from the hospital was organised with diabetics given priority.

8.30 pm 23 February 2011
Forty-two patients plus support people and a dialysis nurse flew to Auckland, where they were met, triaged, fed, accommodated and dialysed if required. Over the following days they were allocated to dialysis units in Whangarei, Waitemata, Auckland, Middlemore, Waikato and Taranaki. It was an extraordinary exercise.

24 February 2011
For those of us remaining in Christchurch the scene was eerily quiet in the Acute Dialysis Unit. A temporary water supply was established and the one non-evacuated patient and one ICU patient were dialysed. While this was occurring, efforts were continued to contact and advise all PD patients. Thankfully the Baxter warehouse was confirmed operational so the PD supply chain had maintained integrity.

The scale of damage to hospital and the city was only beginning to become apparent.

Authorities confirmed that Home Dialysis Training Centre was off limits for the foreseeable future. A skeleton staff continued to provide HD and PD services as required. Staff who were not required due to the lack of patients and facilities commenced ‘earthquake’ leave. Other dialysis staff volunteered elsewhere in the hospital, although this was a challenge as the hospital was ‘overwhelmed’ with volunteers.

We undertook a programme to plan and equip all HD machines in the affected area with Diasafe ultrafilters and carbon filters before any patients returned. Christchurch’s pristine water supply was about to be chlorinated! We also commenced weekly teleconferences with hosting dialysis units. We were also able to undertake a limited one off, escorted access to the Home Dialysis Training Centre to retrieve essential personal items. Water, dirt and the contents of the centre were strewn everywhere.

3 March 2011
The first evacuated patient returned home.

21 March 2011
The first day of dialysis in the Home Dialysis Training Centre. It was operational but only the structure and services were secured. There was still major finishing work ongoing.

9 May 2011
The last evacuated patient returned home. All except three home HD
patients were now re-established at home. However, aftershocks, aftershocks and still more aftershocks are a part of life. Christchurch still moves every day!

What can renal services learn from this tragedy?
It is impossible to plan in any detail for an event such as this. Disasters of this magnitude require the ability to initially make instant decisions and thence to be able to react over hours to days to weeks to months to constantly changing realities: patient and staff safety and welfare, available shelter, loss of buildings/facilities, infrastructure including power, water sewage, transport and so on. Good leadership and management are essential at all levels.

Undertake practice emergency drills, particularly evacuation, seriously. In an earthquake, immediate action is required in an atmosphere of fear, uncertainty, noise, dust and constant movement. Presume that there will be no lifts and that it may be dark. Check regularly that emergency torches work.

Make sure that there are hard-wired phones installed within the facilities (and at home) Any other type of phone is highly likely to fail, especially those that rely on mains power to operate such as cordless phones.

Have an evacuation pack close to the exit. This should be in a single container and hold enough basic supplies to enable removal of AVF cannulas, flushing and locking of CVCs and drainage of intra-abdominal PD fluid in whatever environment evacuees wind up in. Include a battery or dynamo radio.

(For example, evacuation for us literally involved clamping and cutting the bloodlines and leaving. Blood was not returned to patients and machines were left to their own devices; albeit the power was off.)

Acknowledgements
I would like to acknowledge the overwhelming response of the nephrology and dialysis staff who put personal tragedy aside to ensure the safety and wellbeing of their patients. I would also like to acknowledge the equally overwhelming response of the New Zealand nephrology community and the extraordinary efforts of the entire CDHB community in ensuring the maintenance of services under almost overwhelming circumstances.

Update – Monday 13th June 2011
Two more Christchurch earthquakes cause disruptions to water, power and transport. No evacuations as both dialysis units remain operational. Affected home HD patients are being accommodated in our in-centre units.