

How to Improve Acute Stroke Care

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Finland is one of the world's leading nations in the field of acute stroke care. Professor Markku Kaste of Helsinki University Hospital is the maestro behind this unique success story. His young colleague, Associate Professor Atte Meretoja, is now spreading the knowledge about optimum stroke care to places as far away as Melbourne, Australia. At the same time, stroke care is once again evolving: new treatment options are being studied eagerly, and they will push modern imaging technologies even further into the limelight.



How Times are Changing

When Markku Kaste began working in stroke care four decades ago, there was no computed tomography (CT) or magnetic resonance imaging. Stroke patients with intracerebral bleeding survived for three days on average. There was no causal therapy for patients with ischemic stroke. And specialized stroke units were a pipe dream.

Markku Kaste: There was nothing. Many neurologists didn't actually want to treat or see these patients, especially elderly patients, since there was so little that we could do for them. This has changed massively during the last decades. Thanks to modern imaging, we now know exactly what is going on in the brain. Several randomized controlled trials from the 1980s onward made us aware that treating patients in specialized stroke units makes a huge difference: more patients now survive, and the likelihood of long-term disability has fallen considerably. Then intravenous thrombolysis came. We are getting quicker and quicker at administering it, and this means that we are able to rescue brain tissue that would otherwise be lost forever. All this has led to a steady increase in survival rates. There are more and more stroke survivors in Finland these days, and the number will increase further.

Atte Meretoja: We are in the fortunate position of having access to data on how exactly stroke care in Finland has evolved. The national Finnish PERFECT registry shows that, over the last ten years, we were able to reduce stroke mortality from 30 to 25 percent, and this trend is ongoing. Patients with intracerebral hemorrhages are also better off these days. They now survive on average for five years after the bleeding. Stroke incidence, by the way, is interesting to study as well. Finland has the most rapidly aging population in Europe. In spite of this, the overall stroke incidence is pretty steady. In other words: for a given age group, the risk of suffering a stroke is actually falling. This is thanks to better risk factor control. The PERFECT data suggests that we have not only improved stroke care, but also stroke prevention.

Today's Stroke Care in Finland and Beyond

Improvements in stroke care in Finland are not restricted to the Helsinki area: The success story started there, but quickly spread throughout the country. The number of patients who are treated in specialized stroke centers has steadily increased in Tampere and Turku, in Oulu and Joensuu. Overall, 70 percent of all Finnish stroke patients ▶

Professor Markku Kaste (left) and Associate Professor Atte Meretoja (right) are active in spreading the word on optimum stroke care.



are now treated in stroke units. The remaining 30 percent are largely patients in the remote and sparsely populated northern parts of the country. But even then, at least indirect access to stroke specialists is available in most places. Helsinki University offers telestroke services to remote hospitals several hundred times a year, in addition to the 2,000 or so stroke patients treated on-site by the Helsinki neurologists. In fact, stroke patients in remote parts of Finland probably have a better chance of receiving the best care than patients in many other parts of Europe.

Markku Kaste: The European Stroke Initiative carried out a large study with more than 300,000 patients from all the major countries in Europe. It emerged that Europe-wide, only one out of seven stroke patients is admitted to a stroke unit. 42 percent are treated at hospitals with less than 50 stroke patients per year. Such a hospital will not and cannot have the necessary infrastructure for optimum stroke care.

Atte Meretoja: The most interesting figure in this context is the number of patients who get intravenous thrombolysis. In Helsinki, 16 percent of all ischemic stroke patients get intravenous thrombolysis. This is the population-based rate, and it is by far the highest in the world. The second-highest population-based rates are from Germany at 12 percent. In the US, the population-based intravenous thrombolysis rate in ischemic stroke is 4 percent. In Australia and in most European countries, it is probably around 6 percent. Individual hospitals achieve higher rates, for example, the Helsinki University Hospital at 31 percent of all ischemic stroke admissions.

When Speed is King

Using intravenous thrombolysis is one thing, but it is not enough simply to administer it. To be as effective as possible, it has to be used quickly. The neurologists in Helsinki have been working on an optimum protocol for intravenous thrombolysis administration for more than a decade. The target parameter was a reduction in what is called the door-to-needle time. This is the time that passes from the moment the paramedics carry the patient through the entrance door of the hospital until the life-saving thrombolysis is finally administered. Door-to-needle time is of the utmost importance in patients with ischemic stroke, not only for survival but also in terms of quality of life.

Markku Kaste: We have all these calculations that tell us how many neurons we can save by treating the patient quicker. But it is not only neurons. Being quick when a stroke patient comes to the hospital directly translates into quality of life for the patient. We have shown that saving 15 minutes in door-to-needle time means on average one month more of high-quality life for the stroke patient.

Atte Meretoja: In Helsinki, we managed to reduce average door-to-needle time to 18 minutes. This means that we are more than one hour quicker than, for example, our colleagues in the US or indeed in many parts of Europe. This difference adds up to a plus of four months of disability-



“The improvement in stroke care at Helsinki University is absolutely cost-effective”.

Professor Markku Kaste, Head of the Department of Neurology, Helsinki University Hospital



free life. That's a lot. It really makes a difference, not only for the statistics, but for every individual patient.

Step-by-Step Improvements

The massive reduction in door-to-needle time at Helsinki University was a result of several measures that the neurologists introduced step by step over the period of a decade. Kaste, Meretoja, and their colleagues have recently published these steps in the form of a twelve-point priority list. One very important aspect on that list is a better involvement of the emergency medical services. The hospital is pre-notified that a stroke patient will arrive. This makes it possible to pre-order certain tests, to communicate with relatives, to obtain information on the individual medical history, and to take care of some of the usual admission bureaucracy in advance. Another important factor is the relocation of a CT scanner right into the emergency department (ED).

Atte Meretoja: The relocation of the CT scanner in 2004 was a crucial step. It didn't immediately lead to a reduction in door-to-needle time, but it helped us to identify other

bottlenecks that we could eliminate once the CT was available. Because we no longer had to wait for the CT, we realized how important it was to have proper pre-notification. Another example: we learned that, for our stroke patients, it is not necessary to go through the ED cubicle. We transport stroke patients directly into the CT room. We do a brief neurological examination and some point-of-care lab tests and perform the CT examination immediately afterward. The lab results are available as soon as the CT is done. These refinements of the admission processes save us an awful lot of time.

Markku Kaste: Another important aspect is that we have stroke specialists available at the emergency department all the time. We have 40 neurologists in total in our department. This makes it possible to offer a 24/7 service. The interesting thing is that the improvement in stroke care at Helsinki University is absolutely cost-effective. We carried out a monetary analysis for the year 2007, which revealed that we paid 11.3 million euros for 2,000 stroke patients who were treated in our hospital plus 3.2 million euros for the neurological emergency room with its 6000 admissions. The successful treatments with stroke unit care and thrombolysis saved us 14.4 million euros in costs for chronic care. This means that the neurological ER is actually cost-neutral, and the hospital not only gets better stroke care, but also better care for other neurological emergencies like acute seizures. It's like buying a Mercedes and getting a BMW or two on top.

A Blueprint for Other Countries

Finland is only one country. So can the Finnish success story be transplanted to other territories? Atte Meretoja has recently proven that it can be. He left for a fellowship to Australia's University of Melbourne for 18 months to test the applicability of the Helsinki protocol in a totally different healthcare setting. The results were impressive. ▶



Helsinki University Hospital has 40 neurologists on-site and offers telestroke services to remote hospitals several hundred times a year.

Management Summary

According to the experience of Professor Kaste of Helsinki University Hospital, acute stroke care can be optimized substantially by reorganizing processes in the ED. Due to improved communication between emergency service together with hospital and CT imaging made available right in the ED, Helsinki University Hospital was able to get door-to-needle time down to as little as 18 minutes on average. This will substan-

tially increase the likelihood of good patient outcome and reduce the risk of permanent disability after stroke. Arming the ED with neurological expertise will also benefit patients with other neurological emergencies, for example, seizures. In the future, the integration of neuroradiological angiography suites into the acute care setting might make stroke care even more of an interdisciplinary endeavor.

Atte Meretoja: Within a year, the Helsinki result could be duplicated. Measures for process improvement similar to those mentioned above drove door-to-needle time down from 45 to 21 minutes. What was not possible was copying the 24/7 service since the neurological department at the Royal Melbourne Hospital was far smaller than the one in Helsinki. But still, a lot was achieved through relatively simple measures.

Joining Forces

Industry, too, can help to spread the message of better stroke care through process optimization. The Act on Stroke initiative that was launched by Siemens Healthcare Consulting in 2010 specifically aims to improve processes in stroke treatment. Based on a systematic model encompassing care guidelines and clinical expertise, it allows the level of maturity of complex clinical processes to be rated for an individual hospital.

Markku Kaste: We are all in one boat that is heading in the same direction. We will achieve the best results if we join forces. Industry has considerable experience in how to effectively distribute information. It is far better at it than we are. Why not help to distribute printed guidelines, for example? Why not support training projects of the European Stroke Organization? We have to tell our colleagues all over the world in as many face-to-face meetings as possible about how optimum stroke care can and should be organized. That is our duty.

Not Yet Over the Finish Line

What optimum stroke care looks like in the year 2013 can be seen at Helsinki University. But stroke care as it is today is certainly not carved in stone. Stroke therapy could well change considerably in the years to come: intra-arterial clot retrieval devices that can be used to manually extract



Modern stroke care would be inconceivable without rapid brain imaging. At Helsinki University Hospital, reallocating a CT to the emergency department enables thrombolytic therapy to be administered to stroke patients in only 20 minutes.

More Insights into the Finnish Approach

Markku Kaste and Atte Meretoja explain how they improved workflows in the stroke unit of Helsinki University Hospital and how that affected the outcome for the patient.



To watch the video, scan the QR code using the reader app on your smartphone or enter the URL into your browser.

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blood clots and open obstructed cerebral arteries are already being tested in numerous clinical studies. The challenge is to select stroke patients who benefit from these therapies as effectively and – again – as quickly as possible. This will necessitate modern imaging technologies that go well beyond the plain CT imaging that is still, in many places, the standard of care in CT diagnostics.

Atte Meretoja: Intra-arterial therapies are heavily researched in the stroke community worldwide. At our institution, we perform around 50 to 100 recanalizations with intra-arterial devices per year. The global stroke community hasn't nailed the selection criteria for these interventions yet, but I am pretty sure that we will get there over the next couple of years. Imaging will definitely play a role here. At the moment, we supplement the plain CT scan with a CT angiography and a CT perfusion scan in patients who might benefit from interventions in addition to intravenous thrombolysis. It could well be that, in the future, we will use the CT to directly image collaterals or to measure the lengths or even the composition of a clot.

What the Future Holds

Parameters like clot length or the degree of collateralization might help to allocate patients to the best therapies. But they have to be tested rigorously in clinical trials, and indeed they are already being tested.

Markku Kaste: These are exciting times in stroke care. We will see a lot of interesting results from ongoing trials in the years to come. One thing that won't change is that emergency imaging will remain the cornerstone of stroke care. The other thing that will always be true is that good stroke care is about teamwork. Today, paramedics and hospital staff have to cooperate closely to achieve the shortest possible door-to-needle times. And in future, neurologists, interventional neuroradiologists, and neurosurgeons might have to cooperate far more closely than they do today to provide optimum interdisciplinary treatment for our stroke patients. Maybe we will have a common emergency room for diagnosis and treatment of acute stroke patients one day, similar to the cath labs of cardiologists. Who knows? ■



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